

Exhibit 26

1 IN THE UNITED STATES DISTRICT COURT
2 FOR THE SOUTHERN DISTRICT OF WEST VIRGINIA
3 * * * * * *
4 B.P.J., by her next friend and *
5 mother, HEATHER JACKSON, *
6 Plaintiffs * Case No.
7 vs. * 2:21-CV-00316
8 WEST VIRGINIA STATE BOARD OF *
9 EDUCATION, HARRISON COUNTY BOARD OF*
10 EDUCATION, WEST VIRGINIA SECONDARY *
11 SCHOOL ACTIVITIES COMMISSION, W. *
12 CLAYTON BURCH in his official *
13 capacity as State Superintendent, *
14 and DORA STUTLER in her official *
15 capacity as Harrison County *
16 Superintendent, PATRICK MORRISEY in*

17
18 VIDEOTAPED DEPOSITION OF
19 JOSHUA SAFER, M.D.
20 March 24, 2022

21
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24 by the certifying agency.

1 his official capacity as Attorney *

2 General, and THE STATE OF WEST *

3 VIRGINIA, *

4 Defendants *

5 * * * * *

6

7 VIDEOTAPED DEPOSITION OF

8 JOSHUA SAFER, M.D.

9 March 24, 2022

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1 VIDEOTAPED DEPOSITION
2 OF
3 JOSHUA SAFER, M.D., taken on behalf of the Intervenor
4 herein, pursuant to the Rules of Civil Procedure, taken
5 before me, the undersigned, Nicole Montagano, a Court
6 Reporter and Notary Public in and for the Commonwealth
7 of Pennsylvania, taken via videoconference, on
8 Wednesday, March 24, 2022 at 9:30 a.m.

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23
24

A P P E A R A N C E S

JOSHUA BLOCK, ESQUIRE

American Civil Liberties Union Foundation

125 Broad Street

New York, NY 10004

COUNSEL FOR PLAINTIFF

KATHLEEN R. HARTNETT, ESQUIRE

ANDREW BARR, ESQUIRE

JULIE VEROFF, ESQUIRE

ZOE HELSTROM, ESQUIRE

KATELYN KANG, ESQUIRE

Cooley, LLP

3 Embarcadero Center

20th Floor

San Francisco, CA 94111-4004

COUNSELS FOR PLAINTIFF

1 A P P E A R A N C E S (cont'd)

2

3 SRUTI SWAMINATHAN, ESQUIRE

4 Lambda Legal

5 120 Wall Street

6 19th Floor

7 New York, NY 10005-3919

8 COUNSEL FOR PLAINTIFF

9

10 DAVID TRYON, ESQUIRE

11 State Capitol Complex

12 Building 1, Room E-26

13 Charleston, WV 25305

14 COUNSEL FOR STATE OF WEST VIRGINIA

15

16 ROBERTA F. GREEN, ESQUIRE

17 Shuman McCuskey Slicer, PLLC

18 1411 Virginia Street East

19 Suite 200

20 Charleston, WV 25301

21 COUNSEL FOR WEST VIRGINIA SECONDARY SCHOOL

22 ACTIVITIES COMMISSION

23

24

1 A P P E A R A N C E S (cont'd)

2

3 SUSAN DENIKER, ESQUIRE

4 Steptoe & Johnson

5 400 White Oaks Boulevard

6 Bridgeport, WV 26330

7 COUNSEL FOR HARRISON COUNTY BOARD OF EDUCATION and

8 HARRISON COUNTY SUPERINTENDENT DORA STUTLER

9

10 KELLY C. MORGAN, ESQUIRE

11 Bailey Wyant

12 500 Virginia Street East

13 Suite 600

14 Charleston, WV 25301

15 COUNSEL FOR WEST VIRGINIA BOARD OF EDUCATION and

16 SUPERINTENDANT W. CLAYTON BURCH

17

18

19

20

21

22

23

24

1 A P P E A R A N C E S (cont'd)

2

3 ROGER BROOKS, ESQUIRE

4 LAURENCE WILKINSON, ESQUIRE

5 CHRISTIANA HOLCOMB, ESQUIRE

6 JOHNATHAN SCRUGGS, ESQUIRE

7 Alliance Defending Freedom

8 15100 North 90th Street

9 Scottsdale, AZ 85260

10 COUNSEL FOR INTERVENOR, LAINEY ARMISTEAD

11

12

13

14

15

16

17

18

19

20

21

22

23

24

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S T I P U L A T I O N

(It is hereby stipulated and agreed by and between
counsel for the respective parties that reading,
signing, sealing, certification and filing are not not
waived.)

P R O C E E D I N G S

MR. BABWAH: My name is Brandon Babwah.
I'm a notary public out of the State of New York.

VIDEOGRAPHER: We are now on the record.
My name is Jacob Stock. I'm a Certified Legal Video
Specialist employed by Sargent's Court Reporting
Services. The date today is March 24th, 2022. The
current time on the video monitor reads 9:17 a.m.
Eastern Standard Time. This deposition is taken
remotely by videoconference. The caption of this case
is the United States District Court for the Southern
District of West Virginia at Charleston, BPJ, et al.
versus West Virginia State of Board of Education, et
al., Civil Action No. 2:21-cv-00316. The name of the
witness is Joshua Safer. Will the attorneys present
state their names and the parties they represent?

1 ATTORNEY BROOKS: Roger Brooks for the
2 Intervenor, Lainey Armistead, in the room --- in the
3 conference room with the witness. With me is my
4 colleague, Lawrence Wilkerson.

5 ATTORNEY HOLCOMB: Christiana Holcomb for
6 the Intervenor.

7 ATTORNEY TRYON: This is David Tryon
8 representing the State of West Virginia. I'm with the
9 Attorney General's Office.

10 ATTORNEY MORGAN: This is Kelly Morgan on
11 behalf of the West Virginia Board of Education and
12 Superintendent Burch.

13 ATTORNEY DENIKER: Good morning. Susan
14 Deniker representing Harrison County Board of Education
15 and Superintendent Dora Stutler.

16 ATTORNEY GREEN: Roberta Green here on
17 behalf of West Virginia Secondary School Activities
18 Commission.

19 ATTORNEY BLOCK: For the Plaintiff in the
20 room is Josh Block from the ACLU.

21 ATTORNEY SWAMINATHAN: And you have Sruti
22 Swaminathan from Lambda Legal.

23 ATTORNEY HARTNETT: Good morning. This
24 is Kathleen Hartnett from Cooley for the Plaintiff.

1 ATTORNEY BARR: This is Andrew Barr from
2 Coley for Plaintiff.

3 ATTORNEY KANG: Good morning. This is
4 Katelyn Kang from Cooley for the Plaintiff.

5 ATTORNEY HELSTROM: Hello. This is Zoe
6 Helstrom from Cooley for Plaintiff.

7 VIDEOGRAPHER: And if that's everyone,
8 may I ask the notary to swear in the witness?

9 | -----

10 JOSHUA SAFER, M.D.,
11 CALLED AS A WITNESS IN THE FOLLOWING PROCEEDING, AND
12 HAVING FIRST BEEN DULY SWORN BY A NOTARY PUBLIC,
13 TESTIFIED AND SAID AS FOLLOWS:

14 | ---

15 VIDEOGRAPHER: May I also ask the notary
16 to identify himself for the record as well?

17 NOTARY: My name is Brandon Babwah.

18 VIDEOGRAPHER: And at this time the
19 notary may be dismissed and we can begin.

20 ATTORNEY BROOKS: Thank you. And thank
21 you all for making all this complicated stuff work.

22 | ---

23 | EXAMINATION

24 | ---

1 BY ATTORNEY BROOKS:

2 Q. Doctor Safer, good morning. I want to first put
3 in front of you your expert report and your rebuttal
4 report so that you have those if at any point you want
5 to refer to them. It looks --- for convenience let's
6 mark those as Exhibit 1 and 2 for the deposition.

7 ATTORNEY TRYON: Roger, one moment. I'm
8 looking at the realtime, and it's recording you as
9 Attorney Capehart. So I don't know if that needs to be
10 corrected now. And it's showing me as Attorney
11 Hartnett.

12 ATTORNEY BROOKS: She will get that fixed
13 and the record will be correct.

14 ATTORNEY TRYON: Okay.

15 ---

16 (Whereupon, Exhibit 1, Report of Dr. Safer,
17 was marked for identification.)

18 (Whereupon, Exhibit 2, Rebuttal Report of
19 Dr. Safer, was marked for identification.)

20 ---

21 ATTORNEY BROOKS: And at the moment I'm
22 handing copies to the witness. And I would like to mark
23 as Safer Exhibit 3 a short article entitled Fairness for
24 Transgender People in Sport by Joshua Safer.

1 ATTORNEY WILKINSON: Tab 82.

2 ---

3 (Whereupon, Exhibit 3, Fairness for
4 Transgender People in Sports Article, was
5 marked for identification.)

6 ---

7 ATTORNEY BROOKS: And the court reporter
8 will hand the stamped copy to the witness; am I correct?

9 BY ATTORNEY BROOKS:

10 Q. And Doctor Safer, I will ask you questions if
11 you go about your expert reports but let me ask you now
12 to focus your attention on Exhibit Number 3. Am I right
13 that this is an article that you have just very recently
14 published?

15 A. Yes.

16 Q. When did this come out?

17 A. This came out within the past few weeks I think.

18 Q. And this is not a recording of the original
19 research. This is a two page piece simply explaining
20 current issues to the readership of this journal?

21 ATTORNEY BLOCK: Objection to form.

22 THE WITNESS: So this is not original
23 research, that's correct.

24 ATTORNEY BROOKS: Thank you.

1 BY ATTORNEY BROOKS:

2 Q. How would you describe the purpose of this
3 article?

4 A. The purpose of this article is to educate
5 endocrinologists, frame the issues and also serves a bit
6 as a charge to endocrinologists in terms of work that
7 needs to be done.

8 Q. Thank you. If you look at the first column of
9 the first page, in the third paragraph you will see it
10 begins a possible tension exists because of the
11 observation that on average cisgender boys and men have
12 better performance outcomes in athletics than do
13 cisgender girls and women. Do you see that language?

14 A. I do.

15 Q. And you are referring there to the general
16 observation that natal males have better average
17 athletic performance than natal females in a variety of
18 measures.

19 Correct?

20 ATTORNEY BLOCK: Objection to form.

21 THE WITNESS: So I guess I need to be
22 more specific or I can clarify.

23 BY ATTORNEY BROOKS:

24 Q. If you would be more specific.

1 A. So cisgender men at a certain age have better
2 sports outcomes than cisgender women.

3 Q. But you wrote in this just published article
4 that cisgender boys and men have better performance
5 outcomes than the cisgender girls and women.

6 Correct?

7 A. That is correct.

8 Q. And what did you mean in that statement by your
9 reference to boys and girls?

10 A. Boys and girls who are basically --- it depends,
11 it's context I guess. So boys and girls who are
12 developed to that point.

13 Q. So those --- what you had in mind are boys and
14 girls, once the puberty process begins in males in
15 particular?

16 ATTORNEY BLOCK: Objection to form.

17 THE WITNESS: Yes, I guess I would say
18 that what we know is what is towards the end of puberty
19 and subsequent development beyond puberty.

20 BY ATTORNEY BROOKS:

21 Q. You say in the next sentence --- well, let me
22 just clarify, you accept as a scientific fact the
23 general observation that, on average, boys and men,
24 defining boys as you just did, have significantly

1 stronger athletic performance in a variety of metrics
2 than girls and women as you just defined girls; correct?

3 ATTORNEY BLOCK: Objection to form.

4 THE WITNESS: So I guess how I would say
5 that is I accept as fact that men and boys who are
6 appropriately developed have, yeah, have bad performance
7 outcomes in certain sports than do cisgender women and
8 cisgender girls again appropriately developed.

9 BY ATTORNEY BROOKS:

10 Q. And the next sentence reads the performance
11 difference has resulted in the establishment of female
12 only divisions for sport participation for girls and
13 women and safely compete in the live events, closed
14 quote. Do you see that language?

15 A. I do.

16 Q. And there you were, am I correct, explaining the
17 relationship of your observation about male performance
18 with the existence in our society of sex-separated
19 sports.

20 Correct?

21 ATTORNEY BLOCK: Objection to form.

22 THE WITNESS: So I guess --- I would
23 think the way I would say it myself is this is a ---
24 this is the reason why we have the carve-out for the

1 female category.

2 BY ATTORNEY BROOKS:

3 Q. And one reason is to give cisgender girls and
4 women an opportunity to, quote, reliably win events.

5 Correct?

6 ATTORNEY BLOCK: Objection.

7 COURT REPORTER: I'm sorry, Counsel, I
8 can't hear you.

9 BY ATTORNEY BROOKS:

10 Q. One reason, according to what you've written in
11 this article, that there have been a carve-out in a
12 separate female division is to provide girls and women
13 with opportunities to, quote, reliably win events,
14 closed quote.

15 Correct?

16 A. So I guess the way I would say it is if we are
17 going to be really careful with the language here that
18 it would be on average to reliably win events, that is
19 --- yeah, I will leave it at that.

20 Q. Certainly not every girl and women is going to
21 win events, as I know as a male who never won an event?

22 A. Exactly.

23 Q. And another reason, according to this sentence
24 that you wrote, for having a separate category for girls

1 and women is so that they can, quote, safely compete.

2 Correct?

3 A. The word safely in that context is kind of ---
4 accentuates reliably.

5 Q. And you wrote in the next sentence that, quote,
6 the female-only divisions are a major factor to
7 encourage greater participation of girls and women in
8 sports with a goal of equal participation rates.

9 Do you see that language?

10 A. I do.

11 Q. And can you explain to me what you understand or
12 what you were trying to explain as the relationship
13 between having a separate female category on the one
14 hand and encouraging greater participation by women and
15 girls on the other?

16 A. Some of the goals of the people who are in sport
17 who organize sport are to get as high fractions of the
18 population to participate as can be encouraged to do so
19 for sheer health of those individuals and then of
20 everybody. And so the purpose of the carve-out then in
21 these circumstances is to encourage girls and women to
22 participate in larger numbers than they might otherwise.

23 Q. And do you have an opinion, do you have an
24 expert opinion as to whether the existence of separate

1 categories for female sports has in fact been a, quote,
2 major factor in encouraging greater participation by
3 women and girls in sport?

4 A. I don't have an expert opinion.

5 Q. You don't know whether that is objectively true
6 or not?

7 ATTORNEY BLOCK: Objection to form.

8 THE WITNESS: I don't --- right, I can't
9 state as an expert on the details of that subject,
10 that's right.

11 BY ATTORNEY BROOKS:

12 Q. On the second column, in the --- the first full
13 sentence begins many hormone related. Do you see that?

14 A. Yes, I do.

15 Q. Let me read that sentence into the record.
16 Quote, many hormone-related physical characteristics
17 acquired during puberty are not reversed if hormone
18 levels are changed later in life. Can you tell us what
19 physical characteristics associated with typical male
20 development are in your opinion not reversed if hormone
21 levels are changed later in life?

22 A. Again, so I don't know that I would off the top
23 of my head give an exhaustive list but a classic would
24 be height.

1 Q. Would you --- I understand your list may not be
2 exhaustive, but let me ask you to tell us all the
3 examples as you're able to sit here thinking today of
4 physical characteristics acquired during male puberty
5 that are not reversed if hormone levels are changed
6 later in life.

7 ATTORNEY BLOCK: Objection to form.

8 THE WITNESS: I don't know that I could
9 --- I don't know that I would want to accidentally go
10 down that path and conjecture too much, but if I'm
11 expanding a bit on height and thinking about bone
12 characteristics, especially there might be modest change
13 but significant residual bone would be the biggest
14 example. And some other elements --- I can't even say I
15 was about to say a bit proportional, but it's more
16 complicated than that, so other --- other tissues partly
17 influenced by that fact.

18 BY ATTORNEY BROOKS:

19 Q. If we jump down to the next paragraph it begins,
20 quote, the questions arise most with transgender women
21 who began hormone treatment after puberty. And then it
22 continues, quote, the situation includes most
23 transfeminine people because it is most common to
24 undergo endogenous puberty prior to seeking medical

1 interventions appropriate to gender identity. Have I
2 read that correctly?

3 A. Yes.

4 Q. And is it consistent with your experience that
5 most natal males who seek what you refer to as gender
6 confirming treatment do so after experiencing at least
7 most of the ordinary male puberty?

8 ATTORNEY BLOCK: Objection to form.

9 THE WITNESS: Yes. So just terminology,
10 just to be clear, so people who are recorded male at
11 birth who are looking for gender affirming is the term
12 but gender confirming is fine. And sorry, the question
13 there?

14 BY ATTORNEY BROOKS:

15 Q. I will ask it again. Is it consistent with your
16 personal experience that most natal males who seek
17 gender affirming treatment present after undergoing at
18 least most of a natural male puberty?

19 ATTORNEY BLOCK: Same objection to
20 terminology.

21 THE WITNESS: Yes. So most transgender
22 women who come seeking medical treatment have gone
23 through a typical male puberty, that is correct, right
24 now.

1 BY ATTORNEY BROOKS:

2 Q. And in your clinic most of them have gone
3 through what you would consider to be a complete male
4 puberty process?

5 A. I can't answer that completely because we define
6 puberty in this narrow way with the Tanner stages, but
7 then people continue to have development even beyond
8 that to a significant degree.

9 Q. But they have experienced, in your professional
10 experience, at least the bulk of the pubertal changes?

11 A. Yes, I mean the --- I guess --- the way I would
12 say it is, is that most of the transgender women who are
13 coming or even girls who are coming for medical
14 attention have gone through the classic Tanner stages of
15 puberty through Tanner five, which is the last one, by
16 the time they have determined that they're interested in
17 gender-affirming treatment, yes.

18 Q. And let's go back to the very first paragraph of
19 your article in which you mention about five lines down,
20 quote, concern for possible residual athletic advantages
21 from a history of typical male puberty, closed quote.
22 Do you see that language?

23 A. Let me find it. Where is it?

24 Q. It's about five lines down on the very first

1 paragraph of the article.

2 A. Oh, the middle of the sentence, exactly.

3 Q. And so in your opinion, it is concern for
4 possible residual athletic advantages from a history of
5 typical male puberty that drives a great deal of concern
6 about how to address inclusion of natal males who
7 experience a female gender identity in female athletics.

8 Am I correct?

9 ATTORNEY BLOCK: Objection to form.

10 THE WITNESS: So the concern about the
11 residual impact of testosterone during puberty for
12 transgender women who went through a typical male
13 puberty is the source of --- right, is a source of
14 tension at a medical sensitive level, yes.

15 BY ATTORNEY BROOKS:

16 Q. And that's an issue that, for instance, you
17 engage in extensive discussions about in connection with
18 your service on the committee for the IAAF.

19 Am I correct?

20 A. So the --- right, the conversation at World
21 Athletics now, but formerly IAAF, has dealt and I'm sure
22 will continue to deal with that which is the question of
23 to what degree are some of those characteristics, a
24 cause for relevant athletic advantage.

1 Q. And in your opinion, concern about possible
2 residual athletic advantages resulting from a history of
3 typical male puberty is legitimate concern.

4 Right?

5 ATTORNEY BLOCK: Objection to form.

6 THE WITNESS: Right. I don't know that
7 I'm as an expert commenting on its legitimacy. My role
8 on the committee is talking about what is.

9 BY ATTORNEY BROOKS:

10 Q. Do you have any expert opinion as to whether
11 concern for possible residual athletic advantages from a
12 history of typical male puberty is a legitimate concern?

13 A. I'm sorry. Say that again.

14 Q. Do you have any expert opinion as to whether
15 concern for possible residual athletic advantage from a
16 history of a typical male puberty is a legitimate
17 concern?

18 A. I don't know that I would --- again, I don't
19 know that I'm an expert on what is legitimate or not. I
20 come into the room as the scientist talking about what
21 is true and what is not true, what do we know and what
22 do we not know.

23 Q. So on the question then after the science has
24 been put on the table as to how to balance that with

1 other considerations of fairness, of inclusion, that is
2 not your expertise is what you are telling me?

3 A. That is right, that is not my expertise.

4 Q. If we go to page two, in the first column, the
5 second full paragraph begins because testosterone. Do
6 you see that paragraph?

7 A. I do.

8 Q. And you discuss there World Athletic
9 requirements, that is the former IAAF I believe you just
10 testified?

11 A. Yes.

12 Q. And the World Athletics has adopted a
13 requirement to suppress testerone (sic) to five
14 nanomolar per liter testosterone.

15 Correct?

16 A. World Athletics threshold is five nanomolar per
17 liter for those sports where they have a threshold.
18 That's right, yes.

19 Q. And at least formally the International Olympic
20 Committee had a ten nanomolar threshold as part of what
21 you would call out in this paragraph.

22 Is that correct?

23 ATTORNEY BLOCK: Objection to form.

24 THE WITNESS: Yes. So it was the case

1 that the International Olympic Committee Medical Group
2 was trying to form a unified approach just for purposes
3 of organization. And at that time a ten nanomolar per
4 liter suggestion was put out. And that is about as far
5 as it got because it then was shifted to all of the
6 individual international federations.

7 BY ATTORNEY BROOKS:

8 Q. You say in the final sentence of that paragraph,
9 quote, such thresholds are considered to be fair to
10 transgender women because they are well above the 1.7
11 nanomolar per liter target testosterone threshold in
12 medical treatment guidelines, closed quote.

13 Do you see that language?

14 A. Yes.

15 Q. Am I correct that in your professional
16 understanding the 1.7 nanomolar per liter target is set
17 because that's generally believed to be at the upper
18 range of testosterone levels in normal, healthy females?

19 ATTORNEY BLOCK: Objection to form.

20 THE WITNESS: So the 1.7 nanomolar per
21 liter target is the upper level for adults cisgender
22 women.

23 BY ATTORNEY BROOKS:

24 Q. And with that clarified, can you explain to me

1 what you meant by the sentence that I just read, what
2 the point is there?

3 A. The point of the sentence is to --- I guess
4 there are a couple of considerations in terms of
5 determining these numbers, but --- so part of the point
6 is to identify numbers that are feasible for transgender
7 women on their medical treatment.

8 Q. Is there some other point to this sentence in
9 your understanding as it is offered?

10 ATTORNEY BLOCK: Objection to form.

11 THE WITNESS: So the sentence references
12 that piece, but there is the additional context of
13 having a number that is fair to the greater female
14 committee cisgender and transgender too.

15 BY ATTORNEY BROOKS:

16 Q. So it's fair in your judgment to transgender
17 women because the threshold that is being set gives,
18 what should we say, plenty of buffer above what is
19 considered to be the upper range of normal female
20 testosterone levels?

21 ATTORNEY BLOCK: Objection to form.

22 THE WITNESS: Right. So I'm not taking a
23 position on what is fair to be clear.

24 BY ATTORNEY BROOKS:

1 Q. Thank you.

2 A. But the concept of those in the room making that
3 distinction felt that this cutoff would be fair because
4 there would be, indeed, create some buffer and,
5 therefore, people who weren't perfectly at goal would
6 still be included.

7 Q. So because this may be important, let me
8 clarify, when you wrote such thresholds are considered
9 to be fair, you were not offering a personal opinion
10 about fairness but explaining the judgment that had been
11 made by this committee about fairness?

12 A. That's correct.

13 Q. Thank you. And did it cause you personally any
14 concern that the threshold --- that because the
15 threshold that was set was more than three times higher
16 than the upper bounds of testosterone concentrations in
17 normal healthy women, that that might be unfair to the
18 broader population of cisgender women?

19 ATTORNEY BLOCK: Objection to form.

20 THE WITNESS: So to be clear, I'm not
21 rendering an opinion as an expert on what is fair, but I
22 can interpret the considerations of people having these
23 conversations. And so while it is true that the
24 laboratory range for testosterone for healthy cisgender

1 women has an upper limit of 1.7 nanomolar per liter,
2 there are cisgender women who, for a variety of reasons,
3 have numbers higher than that and so that and --- so
4 that is part of the consideration.

5 BY ATTORNEY BROOKS:

6 Q. Let me take you to the two paragraphs below that
7 to the paragraph that begins the societal priorities.
8 Do you see that paragraph?

9 A. I do.

10 Q. The last sentence of that paragraph reads if
11 advantage from testosterone is demonstrated, does
12 society want to implement rules that may indirectly
13 coerce transgender children to begin medical regimens
14 prior to their being ready and that they might never
15 actually choose otherwise, closed quote.

16 Do you see that language?

17 A. I do.

18 Q. Would you explain to me the concern that you are
19 expressing there?

20 A. If a societal goal --- and again here recognize
21 I'm not acting as an expert in this space, but I'm
22 trying to explain to my colleagues what people are
23 discussing. And if our concern is increased
24 participation in sport by various people, then you can

1 envision a circumstance where some girls farther along
2 in puberty have a testosterone advantage that could be
3 demonstrated. Again, not that we even have at this
4 point. And then we would be faced with that question,
5 which is that competing goal of making those transgender
6 girls participate in sports and a recognition if they
7 are sufficiently far along in their development that
8 they may have an advantage if we demonstrate such an
9 advantage.

10 Q. Let me see if I can break that out. Were you
11 talking here about a concern about a hypothetical rule
12 that says to a natal male who identifies as female that
13 you may play if you have suppressed testosterone --- you
14 may play if you have taken puberty blockers at an early
15 age but you may not play if you have not taken puberty
16 blockers from an early stage? Is that the hypothetical
17 structure that you were addressing in this sentence?

18 ATTORNEY BLOCK: Objection to form.

19 THE WITNESS: So the --- it is a
20 hypothetical and it would be that if we make a specific
21 testosterone lowering rule at a scholastic level, might
22 we run into a circumstance where we are encouraging
23 somebody to make medication who might not otherwise take
24 that medication.

1 BY ATTORNEY BROOKS:

2 Q. And staying away from questions of fairness and
3 speaking from what I think is a medical ethics
4 perspective, would you think it raises ethical problems
5 if society were to adopt a rule that permitted certain
6 individuals to compete in female athletics if they had
7 taken puberty blockers but did not permit them to
8 compete with the athletic if they had not taken puberty
9 blockers?

10 ATTORNEY BLOCK: Objection to form.

11 THE WITNESS: I think that's beyond where
12 I'm commenting as an expert witness. Some of that
13 decision is a society decision or for other experts.

14 BY ATTORNEY BROOKS:

15 Q. Do you consider yourself to have some expertise
16 on medical ethics?

17 A. Not as an expert.

18 Q. And you don't feel able --- you don't have any
19 opinion as you sit here today as to whether a policy
20 that created incentives for children to begin medical
21 regimes relating to gender transition could raise
22 medical ethical concerns?

23 A. Not as a medical expert, that's right.

24 Q. In the next paragraph --- and I think we said

1 this is just out in the last couple of weeks, this
2 publication.

3 Right?

4 A. It's very fresh. Number five, so yes.

5 Q. I'm not playing memory games. It says at the
6 top advance access publication 17 March 2022?

7 A. Good.

8 Q. So very recent?

9 A. Yes.

10 Q. And you believe you are reasonably current in
11 the science of this area?

12 A. I am reasonably current, indeed.

13 Q. I didn't ask if you know it all because nobody
14 knows it all, but you say at the beginning of this
15 paragraph much remains unknown scientifically. And you
16 continue, quote, for example, at what point in puberty
17 is advantage from testosterone significant. Is there a
18 point where such advantage would outweigh a priority to
19 outweigh all participants --- all to participate in
20 sport of some sort, closed quote.

21 Do you see that language?

22 A. I do.

23 Q. And actually the point in writing the second
24 sentence there --- strike that.

1 Let me just ask this in general. Do you have
2 an opinion as to how much of a performance advantage
3 would count for those --- for natal males versus natal
4 females, how much of a performance advantage would be,
5 quote, significant?

6 ATTORNEY BLOCK: Objection to form.

7 THE WITNESS: I do not have an opinion.

8 BY ATTORNEY BROOKS:

9 Q. And in your view, is that even a scientific
10 question?

11 ATTORNEY BLOCK: Objection to form.

12 THE WITNESS: Let me think. No, that
13 isn't a scientific question.

14 BY ATTORNEY BROOKS:

15 Q. And you --- and the next sentence is there a
16 point where an advantage, such an advantage would
17 outweigh a priority to motivate all to participate. Am
18 I correct that you also don't consider that to be a
19 scientific question?

20 A. That is correct.

21 Q. That is a value judgment?

22 ATTORNEY BLOCK: Objection to form.

23 THE WITNESS: So it's not a scientific
24 question. I can go a little more in --- I can expand a

1 little bit there which is to say that we have various
2 advantages and degrees of unfairness. So what could be
3 a scientific question, if we knew the answers, would
4 include the degree of advantage for some circumstance
5 versus another circumstance where we are able to measure
6 those things.

7 BY ATTORNEY BROOKS:

8 Q. But the question of whether an advantage on the
9 one hand outweighs a desire to be inclusive on the other
10 hand is a value question, not a scientific question?

11 ATTORNEY BLOCK: Objection to form.

12 BY ATTORNEY BROOKS:

13 Q. In your opinion.

14 ATTORNEY BLOCK: Objection to form.

15 THE WITNESS: So I guess I would just go
16 back to saying how I said it, which is the scientific
17 question in there would be to provide that degree of
18 difference and show, for example, that this would be ---
19 this is small advantages versus someone that we are
20 already do in society as big advantage and that would be
21 how --- that would be the role of the scientist.

22 BY ATTORNEY BROOKS:

23 Q. I understand that's what you would like to say,
24 but my question for you is, in your opinion, is the next

1 step of deciding of whether that advantage which has now
2 been scientifically detailed outweighs a priority to
3 motivate all to participate is a value decision.

4 ATTORNEY BLOCK: Objection to form.

5 THE WITNESS: Yeah, I don't --- I guess I
6 can't as an expert say for certain that in all
7 circumstances that is a value to consider.

8 BY ATTORNEY BROOKS:

9 Q. You continue among your lists of things that
10 are, quote, unknown scientifically, quote, for those who
11 have completed puberty, what duration of
12 testosterone-lowering treatment is sufficient to create
13 a level playing field in a given sport, closed quote.

14 Do you see that?

15 A. Yes.

16 Q. And in your view, the question of what duration
17 of testosterone lowering treatment, if any, can be
18 sufficient to create a level playing field in a given
19 sport is currently unknown scientifically?

20 ATTORNEY BLOCK: Objection to form.

21 THE WITNESS: It's unknown scientifically
22 across virtually all sports. What duration of
23 testosterone lowering raises what degree of advantage.
24 It's just at that level. To go to the level playing

1 field is a whole further tier.

2 BY ATTORNEY BROOKS:

3 Q. And in your final paragraph I think you said at
4 the beginning that, in part, this was a call to the
5 field of endocrinology for needed research. In the
6 final paragraph you say, quote, we in the endocrine
7 healthcare community have much work to do to create an
8 evidence base to help guide decision makers so the
9 choices for transgender women in sport are data driven,
10 closed quote.

11 Have I read that language correctly?

12 A. Yes.

13 Q. So it's your view as of 2002 that the data that
14 we have available today are insufficient to enable data
15 driven choices about transgender participation in female
16 athletics.

17 Correct?

18 ATTORNEY BLOCK: Objection to form.

19 THE WITNESS: I would say that in 2022 we
20 have insufficient data to --- how would I say this, we
21 have insufficient data to make rules for, let's say,
22 transgender women, mostly talking about older more
23 developed people, that would address these concerns for
24 participation.

1 BY ATTORNEY BROOKS:

2 Q. Let me ask you to find your initial expert
3 report, which is Exhibit-1, and there I will ask you to
4 turn to paragraph 58. At the beginning of paragraph 58
5 you wrote in this report executed on January 21, 2022,
6 which is two months prior to the publication date of the
7 article we just looked at --- and actually, let me pause
8 and ask you, when did you write the article that we just
9 looked at? And the process always grinds on for a
10 little while. When do you think you substantially
11 completed the task?

12 A. I honestly don't remember.

13 Q. Sorry. The question was when do you think you
14 substantially wrote the text in the article that you
15 just looked at?

16 A. I honestly don't remember the details. We can
17 talk in years, so it would be 2022 and back into 2021.

18 Q. Okay.

19 So about the same time that you were preparing
20 this expert report?

21 A. There certainly would be some overlap.

22 Q. You wrote in paragraph 58, quote, even if
23 evidence were eventually to show that on average
24 transgender women have some level of advantage compared

1 to average non-transgender women, closed quote.

2 Do you see that language?

3 A. I do.

4 Q. Now, in fact, you are aware of substantial
5 evidence that, on average, transgender women do have
6 some level of advantage compared to advantage
7 non-transgender women.

8 Correct?

9 ATTORNEY BLOCK: Objection to form.

10 THE WITNESS: No, I'm not. So that isn't
11 my statement.

12 BY ATTORNEY BROOKS:

13 Q. And is the question --- so you served on the
14 IAAF Committee discussing questions of testosterone
15 levels. And in that context you did not become
16 acquainted with data showing that on average transgender
17 women have some level of advantage compared to average
18 non-transgender women?

19 A. Not in --- so, no. In the context of specific
20 sports, no.

21 Q. Do you consider the question of how much
22 advantage natal males have over natal females in
23 particular sports to be within your professional
24 expertise?

1 ATTORNEY BLOCK: Objection to form.

2 THE WITNESS: So sorry --- so cisgender
3 men versus cisgender women, that difference at an adult
4 level, is at my expertise to know that degree of
5 difference? Is that the question?

6 BY ATTORNEY BROOKS:

7 Q. It is.

8 A. No, that is not my expertise.

9 Q. And is it within your expertise to know the
10 level of advantage enjoyed by natal males who have
11 transitioned to female gender identity over cisgender
12 women in any particular sport?

13 ATTORNEY BLOCK: Objection to form.

14 THE WITNESS: So in the --- so if we are
15 talking cisgender women versus transgender women, it
16 would be in my expertise to know what data we have on
17 this subject, which is different from knowing the degree
18 of difference because we don't have those data.

19 BY ATTORNEY BROOKS:

20 Q. You say in paragraph 60, let me find this,
21 quote, there is no inherent reason why transgender women
22 physiological characteristics related to athletic
23 performance should be treated as any more of an unfair
24 advantage than the advantages that already exist among

1 different women athletes. Do you see that language?

2 A. I do.

3 Q. Now, earlier you told me rather emphatically
4 that the question of fairness is outside your
5 professional expertise.

6 Correct?

7 ATTORNEY BLOCK: Objection to form.

8 THE WITNESS: It is outside my expertise.

9 BY ATTORNEY BROOKS:

10 Q. So why did you offer here an opinion about what
11 is fair or unfair?

12 ATTORNEY BLOCK: Objection to form.

13 THE WITNESS: Right. So I'm not
14 determining the fairness per se as an expert, but I'm
15 simply talking about the inputs where somebody who is
16 determining what is fair --- where somebody is
17 determining what is fair would consider.

18 ATTORNEY BROOKS: Let me mark as Safer
19 Exhibit 4 an article by Professor Handelsman entitled
20 Circulating Testosterone on a Hormonal Basis of Sex
21 Differences in Athletic Performance.

22 ---

23 (Whereupon, Exhibit 4, Professor Handelsman
24 Article, was marked for identification.)

1 ---

2 ATTORNEY WILKINSON: Tab 18.

3 VIDEOGRAPHER: I'm sorry, what tab is it?

4 ATTORNEY BROOKS: Tab 18.

5 BY ATTORNEY BROOKS:

6 Q. And Doctor Safer, am I correct this is an
7 article that you read with some care?

8 A. This is an article that I read with some care.

9 Q. You cited in your expert report.

10 Correct?

11 A. I think so.

12 Q. I think so, too. It's not a memory test. I
13 retract the question. We will come to it shortly.

14 Let me ask you to turn in --- and let me ask
15 you, do you know Professor Handelsman personally?

16 A. I do not.

17 Q. Have you encountered him in any other actions?

18 A. I have.

19 Q. Once, more than once?

20 A. That is also a trick question for me. For sure
21 once.

22 Q. Okay.

23 Do you consider him to have a high reputation
24 in the field?

1 A. If that question is as an expert I can't --- I
2 won't comment, but he certainly has published widely and
3 we quote him.

4 Q. What do you mean by we in that answer?

5 A. The rest of us in the field and I certainly
6 quote him in an expert opinion.

7 Q. All right.

8 And this article in particular we note you
9 widely reference?

10 A. This article is --- yeah, I think that is
11 actually a fair thing to say. It is as widely
12 referenced as anything in a relatively small field.

13 Q. Let me ask you to turn to the second page of
14 this article where Professor Handelsman in the first
15 full paragraph --- the second full paragraph begins
16 nevertheless. He says, quote, fairness is an elusive
17 subjective concept with malleable boundaries that may
18 change over time as social concepts of fairness evolve.

19 Do you see that?

20 A. I do.

21 Q. Do you agree with that statement?

22 A. As an expert I can't comment.

23 Q. You don't purport to be able to give any
24 definition of fairness?

1 ATTORNEY BLOCK: Objection to form.

2 THE WITNESS: Yes, not as an expert.

3 BY ATTORNEY BROOKS:

4 Q. And you don't have any opinion as to whether
5 standards of fairness can change over time?

6 ATTORNEY BLOCK: Objection to form.

7 THE WITNESS: I'm aware of the
8 conversation on the subject, of course, but if you are
9 asking me to comment as an expert, then no.

10 BY ATTORNEY BROOKS:

11 Q. If the actual evidence shows that the actual
12 scientific data were to show that, quote, on average
13 transgender women have, closed quote, a very large
14 advantage compared to average non-transgender women,
15 would you then have any view as to whether permitting
16 non-transgender women to compete in female categories is
17 fair?

18 ATTORNEY BLOCK: Objection to form. I'm
19 sorry, what's the quotation?

20 BY ATTORNEY BROOKS:

21 Q. If actual data were to show that on average
22 transgender women have a very large advantage compared
23 to non-transgender women, then would you have any
24 opinion as to whether it is fair to permit the

1 transgender women to compete in the female category?

2 ATTORNEY BLOCK: Objection to form.

3 THE WITNESS: No, that would not change.

4 I would simply as an expert I would talk about those
5 degrees of difference as information.

6 BY ATTORNEY BROOKS:

7 Q. But you would offer no opinion as to whether
8 permitting the participation in the female category was
9 or was not appropriate?

10 A. I would not offer an expert opinion. That's
11 right.

12 Q. Now, you say in paragraph 60 of your expert
13 record that there is, quote, no inherent why transgender
14 women's physiological characteristics related to
15 athletic performance should be treated as any more of an
16 unfair advantage than the advantages that already exist
17 among different women athletes, close quote. We have
18 looked at that language.

19 Correct?

20 A. You are reading that correctly.

21 Q. Thank you.

22 A. Whatever the question is.

23 Q. No question beyond that so far. And your point
24 I take it is that for any given sport some women just

1 have substantially more favorable physiques than others?

2 ATTORNEY BLOCK: Objection to form.

3 THE WITNESS: Right. So for any given
4 sport some women have advantages relatively to others,
5 yes.

6 BY ATTORNEY BROOKS:

7 Q. And in basketball some are simply genetically
8 going to be substantially taller than others?

9 A. In basketball some are taller than others, yes.

10 Q. I'm not speaking for you, I, at 5'8", in my
11 shoes for instance was --- am just physiologically
12 disadvantaged for basketball compared to a man who is
13 6'10"?

14 ATTORNEY BLOCK: Objection to form.

15 THE WITNESS: So as an expert I actually
16 wouldn't go there because there are other
17 characteristics in basketball per se.

18 BY ATTORNEY BROOKS:

19 Q. That's true, although I have none of them. But
20 is it, in your view, equally true that there is no
21 inherent reason why cisgender men's physiological
22 characteristics related to athletic performance should
23 be treated as any more of an unfair advantage for
24 competing in the women's category than the advantages

1 that already exist among different women athletes?

2 A. So yeah, let's go through this more slowly a
3 second so I'm clear.

4 Q. All I did was substitute cisgender men for
5 transgender women in that sentence. And my question is
6 doesn't your argument as stated there apply exactly with
7 equal force to cisgender male?

8 A. No.

9 Q. Why is that?

10 A. When we talk about --- when we're talking about
11 a range of characteristics among a range of people
12 versus something that might be systematically true or
13 not and so it just --- so the answer just ends up being
14 more complex.

15 Q. Well, you have testified that most natal women
16 --- pardon me, you testified that most natal males with
17 female gender identity have undergone at least the
18 majority of male puberty before they present for gender
19 affirming treatment.

20 Correct?

21 ATTORNEY BLOCK: Objection to form.

22 THE WITNESS: So most cisgender women
23 when they come to medical attention have gone through a
24 significant puberty, the five Tanner stages.

1 BY ATTORNEY BROOKS:

2 Q. And just to clarify, to use your terms, in
3 giving that answer you said cisgender women. That is
4 not what you meant.

5 Correct?

6 A. That is not what I meant, thank you.
7 Transgender women.

8 Q. And therefore, they systematically have gone
9 through --- systematically gone through physiologic
10 changes associated with male puberty?

11 ATTORNEY BLOCK: Objection to form.

12 THE WITNESS: So the --- so they --- they
13 have gone through male puberty. And there is something
14 on average that may be true there, but whether that
15 relates to an advantage in a specific sport I can't go
16 there.

17 BY ATTORNEY BROOKS:

18 Q. Well, the example that you gave earlier of a
19 systematic difference resulting from male puberty that
20 these transgender women enjoy is height, that is you
21 mentioned that earlier.

22 Correct?

23 A. Uh-huh (yes).

24 Q. So again, let me ask, given that according to

1 your testimony and experience the substantial majority
2 of transgender women have undergone most of male
3 puberty, why is it not equally true that there is no
4 inherent reason why cisgender men's physiological
5 characteristics related to athletic performance should
6 be treated as any more of an unfair advantages than the
7 advantages that already exist among different women
8 athletes?

9 A. So if I'm following this correctly then it's ---
10 then the answer to the question why are cisgender men
11 different than transgender women?

12 Q. Why does this logic apply differently to the
13 cisgender men than to the transgender women?

14 A. So let's see. It actually doesn't. So if you
15 have a sport where that --- where the advantage or ---
16 for the --- where a known advantage for cisgender men
17 versus cisgender women was sufficiently modest, and
18 again, I wouldn't be the judge of that, but you could
19 envision that becoming a coed sport.

20 Q. Are you offering an opinion that either
21 government or leagues have an obligation to do an
22 individual by individual assessment as to whether a
23 particular natal male who experiences a female gender
24 identity does or does not enjoy a physiological

1 advantage in the sport they wish to play in as a result
2 of typical male development that they had gone through?

3 ATTORNEY BLOCK: Objection to form.

4 THE WITNESS: Right, I'm not offering an
5 opinion. It was a long question.

6 BY ATTORNEY BROOKS:

7 Q. Would you like to hear the question back?

8 A. Sure, but I'm not offering an opinion on several
9 aspects.

10 ATTORNEY BROOKS: Would you read that
11 question back, please?

12 ---

13 (COURT REPORTER READS BACK PREVIOUS QUESTION.)

14 ---

15 BY ATTORNEY BROOKS:

16 Q. And your answer is?

17 A. So I'm not offering an opinion. I should expand
18 a bit because how that question was phrased as an
19 individual by individual person and most of these rules
20 are across a group of sports.

21 Q. And my question was about an individual person.

22 A. Your question was an individual person, but ---.

23 Q. Right. Looking at your paragraph 60, again, do
24 you believe there is --- are you offering an opinion ---

1 let me start that again. Are you able to identify for
2 me any inherent reason why a relatively weak or small or
3 slow male --- strike that.

4 You referenced in your report and also the
5 article we just looked at the IAAF regulations that
6 excluded from the female category any individual who has
7 circulating testosterone higher than five nanomolar per
8 liter. Do you recall that?

9 ATTORNEY BLOCK: Objection to form.

10 THE WITNESS: So just to clarify, it is
11 not --- that rule for five nanomolars is not across all
12 sports.

13 BY ATTORNEY BROOKS:

14 Q. And which sports in your recollection did that
15 apply to?

16 A. Yeah, that's --- I don't remember off the top of
17 my head.

18 Q. At the very least it applied to track events.
19 Correct?

20 A. It does. But if you start to quiz me on the
21 specific distances, I won't get that.

22 Q. And nor will I so quiz you. And that
23 requirement as applied to track competition was, in
24 fact, the subject of a major international arbitration,

1 as you're aware.

2 Correct?

3 A. If we're referencing the Caster Semenya case,
4 yes.

5 Q. Did you yourself have any participation in that
6 arbitration?

7 A. I did not.

8 Q. Do you know whether Doctor Handelsman had any
9 participation in that?

10 ATTORNEY BLOCK: Objection.

11 THE WITNESS: I don't know off the top
12 off of my head.

13 BY ATTORNEY BROOKS:

14 Q. Have you ever read the arbitrarial decision in
15 that case?

16 A. I'm certain I read excerpts, but that is as much
17 as I could say.

18 Q. Okay.

19 You participated in developing on the --- a
20 member of the committee that developed the regulation
21 that you've referenced, the 7.5 nanomolar threshold?

22 A. I was on the committee that helped determine
23 that particular threshold conceptual, yes.

24 Q. And you're aware that in addition to individuals

1 such as Caster Semenya, who suffered of a disorder of
2 sexual development, that that rule would exclude some
3 transgender women from female athletics that were
4 subject to that IAAF rule.

5 Correct?

6 ATTORNEY BLOCK: Objection to the
7 terminology.

8 THE WITNESS: So I was aware that by
9 setting a threshold that there --- and even that
10 threshold in particular, that there would be transgender
11 women who would not achieve that threshold for whatever
12 reason.

13 BY ATTORNEY BROOKS:

14 Q. And did you nevertheless consider the regulation
15 to be reasonable?

16 A. If you are asking me as an expert, then again I
17 can't comment.

18 Q. Well, let me just ask you as Doctor Safer.

19 A. Am I allowed to ---?

20 ATTORNEY BLOCK: Objection to form.

21 BY ATTORNEY BROOKS:

22 Q. You are allowed.

23 A. Okay. So having a rule does make sense to me,
24 yes.

1 Q. And you thought that that rule was reasonable?

2 A. As with the data we have currently, yes,
3 personally.

4 Q. And what, in your opinion, is the inherent
5 reason that advantages conferred by testosterone levels
6 far outside the normal female range should be treated as
7 any more of an unfair advantage than the advantages that
8 already exist among different women athletes?

9 ATTORNEY BLOCK: Objection. I'm sorry.
10 Can you clarify as an expert or as an individual just
11 because you shifted back and forth?

12 BY ATTORNEY BROOKS:

13 Q. First as an expert.

14 A. So yes --- give me the question again. I'm
15 sorry.

16 Q. What, in your opinion, is the inherent reason
17 that advantages conferred by testosterone levels outside
18 the normal female range should be treated as any more of
19 an unfair advantage than the advantages that already
20 exist among different women athletes?

21 A. So to clarify we --- so, okay, let me go back.
22 Let me answer in pieces I guess or ask you to say it in
23 pieces. So what is different between typical male
24 levels of testosterone in an individual and some other

1 characteristics that are across the range of
2 characteristics of cisgender women? Is that the
3 question? Am I rephrasing that correctly?

4 Q. I'm actually referencing paragraph 60 of your
5 expert report, but my question --- and let's take for
6 instance, a natal male who has press testosterone but
7 only achieved six nanomolar per liter concentration, do
8 you have that concentration, do you have that in mind?

9 A. A transgender woman whose testosterone level is
10 six.

11 Q. Right. What in your opinion is the inherent
12 reason that advantages conferred by testosterone levels
13 above a threshold such as five nanomolars should be
14 treated as any more of an unfair advantage than the
15 advantages that already exist among different women
16 athletes?

17 ATTORNEY BLOCK: Objection to form.

18 THE WITNESS: So a couple of things.
19 First of all, I don't know that a testosterone level of
20 six is from a scientific perspective demonstratively
21 different than a testosterone level of five. It's just
22 a matter of affecting it overall. So I want to clarify
23 that. It's not that --- that that small degree is
24 necessarily relevant. And I can't even say that we

1 demonstrated advantage. It's still a theoretical with
2 regard to some of those higher testosterone levels. Let
3 me think about those for a second. Yes, so some of the
4 logic pattern for having a threshold is in order to be
5 able to limit the entire conversation to dealing with
6 transgender women or women with --- or intersex women or
7 women who for any reason have have elevated testosterone
8 levels and not to open the door at the elite level for a
9 participation by cisgender men posing as cisgender women
10 if that makes sense.

11 BY ATTORNEY BROOKS:

12 Q. Is there, in your judgment, any inherent reason
13 that advantages conferred by testosterone levels well
14 outside normal female ranges should be treated as any
15 more of an unfair advantage than the advantages that
16 already exist among different women athletes?

17 A. So I have to go back to that one. Is it my
18 opinion that male level testosterone levels ---?

19 Q. Let me --- my question is testosterone levels
20 significantly above normal female ranges?

21 A. Are --- then no, sorry. It took me a little
22 while to get there, but no.

23 Q. Because the question was complicated and the
24 answer was broken up I will ask you again, not to insult

1 you but so we have a clear record. I think I understood
2 your answer but is there, in your opinion, any reason
3 why advantages provided by testosterone level well
4 outside normal female ranges should be treated as any
5 more of an unfair advantage than the advantages that
6 already exist among different women athletes?

7 ATTORNEY BLOCK: Objection to form.

8 THE WITNESS: And as an expert I'm not
9 rendering an opinion there, that's right.

10 BY ATTORNEY BROOKS:

11 Q. Okay.

12 In paragraph 55 of your ---.

13 ATTORNEY BLOCK: Would now be a good time
14 for a break?

15 ATTORNEY BROOKS: Let me just ask this
16 one question and then yes.

17 BY ATTORNEY BROOKS:

18 Q. In paragraph 55 you cite a 2015 article by
19 Joanna Harper?

20 A. I do, yes.

21 Q. Have you ever met Joanna Harper?

22 A. I have.

23 Q. And have you collaborated with Joanna Harper in
24 any way?

1 ATTORNEY BLOCK: Objection to the form.

2 THE WITNESS: Yeah, I don't, but I guess
3 --- it's a complicated answer, so I need to know what
4 you mean by that.

5 BY ATTORNEY BROOKS:

6 Q. I mean it broadly. Have you worked with her on
7 any sorts of projects or committees?

8 A. Well, we were both in the working group for
9 World Athletics that helped develop this threshold.

10 Q. And do you consider Doctor Harper to be
11 knowledgeable in the field of sports physiology?

12 A. I do.

13 Q. And do you consider Doctor Harper to be
14 knowledgeable with regard to the impact of testosterone
15 suppression on athletic capabilities in male?

16 A. So do I consider her to be knowledgeable in the
17 field? I certainly do. For what it's worth, she is
18 still Ms. Harper. She's actually in the Ph.D. program
19 now.

20 Q. Oh, okay. I just gave her an honorary degree.

21 A. She occupies a prominent place in the field.

22 ATTORNEY BROOKS: Let's take that break.

23 VIDEOGRAPHER: Going off the record. The
24 current time is 10:25 a.m. Eastern Standard Time.

1 OFF VIDEOTAPE

2 ---

3 (WHEREUPON, A SHORT BREAK WAS TAKEN.)

4 ---

5 ON VIDEOTAPE

6 VIDEOGRAPHER: We are back on the record.

7 Current time reads 10:39 a.m. Eastern Standard Time.

8 BY ATTORNEY BROOKS:

9 Q. Dr. Safer, let me ask you to go back to Exhibit
10 4 Professor Handelsman's article. And if you would turn
11 in that article to page 805, the first paragraph begins
12 the strongest classification in a league sport is that
13 after puberty men 20 times more testosterone than women.

14 Do you see that language?

15 A. I do.

16 Q. And he discusses a number of results and ends
17 his paragraph by saying in concert --- quote, in concert
18 these render women on average unable to compete
19 effectively against men in power based or endurance
20 based sports.

21 Do you see that?

22 A. I do.

23 Q. And do you consider yourself qualified to
24 evaluate Professor Handelman's assertion that women are

1 on average unable to compete effectively against men in
2 power based or endurance based sports?

3 A. No.

4 Q. Not qualified?

5 A. Not qualified, correct.

6 Q. Do you believe you have an understanding ---
7 well, let me ask you this. Do you consider yourself
8 qualified to offer any opinion as to why sports have
9 been separated by sex historically?

10 A. I guess I would say I'm aware of the history.

11 Q. And in your understanding what is the reason
12 that sports have been separated by sex historically?

13 A. The history is that at a certain point where
14 sufficient development has taken place there is a
15 differential in at least some sports between men and
16 women --- between cisgender men and cisgender women such
17 that in order for women to win those events reliably
18 there needs to be a carve-out.

19 Q. And as you sit here today can you identify for
20 me any sport in which you believe that cisgender men
21 after puberty do not enjoy a significant performance
22 advantage over cisgender women?

23 A. Yes.

24 Q. Please do.

1 A. Examples include --- well, I guess I better not
2 get too far and be the expert here, but I believe
3 riflery and others in the category of hand/eye
4 coordination. I think some of the equestrian sports are
5 examples.

6	Q.	Okay.
---	----	-------

7 You are not offering any opinion, are you, that
8 the reason for separation of sports by sex is to affirm
9 sex specific social roles or identities?

10 A. I'm not aware of that. I'm not an expert on
11 those pieces, but I'm not aware personally.

12 Q. And it is not your opinion, is it, that
13 separation of sport by sex is in general unfair?

14 ATTORNEY BLOCK: Objection to form.

15 THE WITNESS: So again, as an expert I'm
16 not commenting on fairness.

17 ATTORNEY BROOKS: I'm going to mark as
18 Safer Exhibit 5, a Decision in the arbitral award
19 delivered in the Court of Arbitration for Sport in
20 connection with the arbitration between Athletic South
21 Africa and the IAAF, a bulky document, unfortunately.

22 | ---

23 (Whereupon, Exhibit 5, Court of Arbitration
24 for Sport Decision, was marked for

1 identification.)

2 ---

3 BY ATTORNEY BROOKS:

4 Q. And Doctor Safer, now that you have --- I asked
5 you earlier about whether you had seen the arbitration
6 decision and I think you said you might have read
7 excerpts of it. Looking at it today, do you believe
8 that you have ever seen a copy of the whole Decision?

9 A. I do not think I've read through the whole
10 Decision.

11 Q. Do you think you've ever held this whole
12 document in your hand before?

13 A. This is the first time that I held the whole
14 document.

15 Q. I'm going to ask you about a few quotations in
16 it, not to ask your opinions about the judgment but to
17 elicit your opinions about the science. So if you would
18 turn --- and the structure of the document is that
19 everything in it has a paragraph number which, thank
20 goodness, makes it easy to find things. So if you would
21 turn to paragraph 556. The first sentence of
22 paragraph 556 of this Decision reads there is no dispute
23 that ensuring fair competition in the female category of
24 elite competitive athletics is a legitimate objective

1 for the IAAF to pursue, closed quote. As a member of
2 the IAAF Committee that established the policy that was
3 challenged in this arbitration, do you agree or disagree
4 that there is no dispute that ensuring fair competition
5 in the female category is a legitimate objective for the
6 IAAF to pursue?

7 ATTORNEY BLOCK: Objection to form.

8 THE WITNESS: As an expert I do not have
9 an opinion.

10 BY ATTORNEY BROOKS:

11 Q. Okay.

12 Let me ask you to turn to paragraph 456. And
13 this arbitration, as you noted, deals with the case of
14 Caster Semenya and therefore with track events, not with
15 riflery or with equestrian events. So I will ask your
16 reaction to that context. In the middle of
17 paragraph 456, beginning halfway through the sixth line
18 the panel wrote, quote, suffice to say that post puberty
19 generally speaking males outperform female athletes ---
20 I'm sorry, male athletes outperform female athletes at
21 an elite level. This difference is insurmountable,
22 closed quote.

23 Do you see that?

24 A. I do.

1 Q. And do you believe it to be true, false or
2 outside of your expertise that male athletes outperform
3 female athletes at the elite level at a difference that
4 is insurmountable?

5 ATTORNEY BLOCK: Objection to form.

6 THE WITNESS: As a blanket statement, no,
7 I would say that is not my expertise.

8 BY ATTORNEY BROOKS:

9 Q. Let me ask you to turn to 576. I said 576. I
10 meant 577. I apologize. At the end of 577 the panel
11 has written, quote, ---.

12 ATTORNEY BROOKS: We just had static
13 here, so let me ask whether people outside the
14 conference room are hearing us? If somebody could
15 unmute.

16 ATTORNEY TRYON: I can hear you.

17 ATTORNEY BROOKS: We just had some static
18 that caused me concern.

19 BY ATTORNEY BROOKS:

20 Q. At the end of paragraph 577 the panel wrote,
21 quote, male athletes do not have to be elite to surpass
22 even the very best female athletes. Dr. Berman pointed
23 out that in a race such as the 800 meter, a 1.6 percent
24 advantage, as calculated in BG17, was sufficient to

1 determine first place by the region of nine meters,
2 closed quote.

3 Do you see that language?

4 A. Yes.

5 Q. And do you consider it to be true, false or
6 outside your expertise that male athletes do not even
7 have to be elite to surpass the very best female
8 athletes?

9 ATTORNEY BLOCK: Objection to form.

10 THE WITNESS: In a --- as a blanket
11 statement it is outside my expertise.

12 BY ATTORNEY BROOKS:

13 Q. And do you have an opinion as to whether a
14 1.6 percent advantage is a significant advantage or
15 insignificant advantage?

16 A. I think that's too complicated as phrased for me
17 to answer.

18 Q. That's actually one of the simpler questions
19 that I've asked today. Let me ask it again and ask you
20 to think. Do you have an opinion, and if you --- one
21 answer of course is I don't have an opinion or it is
22 outside of my expertise, but do you have an opinion as
23 to whether a 1.6 percent advantage in a track event is a
24 significant advantage?

1 ATTORNEY BLOCK: Objection to form.

2 THE WITNESS: So it depends on the event.

3 BY ATTORNEY BROOKS:

4 Q. Why does it depend on the event?

5 A. Well, there are events where we see --- as an
6 elite Olympic event where the runners are virtually
7 tied. And 1.6 percent then will be significant in the
8 moment because that will be described in that field.
9 And yet there are other events where people are far more
10 spread out and there's greater --- in every element,
11 then 1.6 percent advantage becomes lost in that noise.

12 Q. And --- well, let's take competitive high school
13 athletics, competitive high school track. Do you have
14 an opinion as to 1.6 percent advantage in that context
15 is significant or insignificant?

16 A. I do not have an opinion.

17 Q. So if I understand correctly, your point in some
18 context you know that 1.6 percent is significant but
19 that in other context you don't know one way or the
20 other?

21 ATTORNEY BLOCK: Objection to the form.

22 THE WITNESS: Yes, I guess I would say
23 that in some context I can see that 1.6 percent is
24 significant and then in other context I can see that 1.6

1 percent does not appear to be significant. And actually
2 even if you're asking as an expert, what even is
3 significant is outside my purview, but with that
4 understood I can still see that someone would say it one
5 way and not say it the other way.

6 BY ATTORNEY BROOKS:

7 Q. Let me ask you to turn to paragraph 357. And
8 first I will ask you to turn to page 88, paragraph 351,
9 just so you can see we're in a section summarizing the
10 testimony of Professor David Handelsman. That begins at
11 paragraph 351. And then I'm going to call your
12 attention to paragraph 357 and it puts you to the
13 statement there.

14 357 includes a number of bullet points. The
15 third bullet point, which is on page 91, reads --- and
16 again this is --- the paragraph begins, quote, Professor
17 Handelsman went on to explain in greater detail why the
18 sex difference in circulating testosterone is the cause
19 of the difference in athletic performance between men
20 and women, and then there are bullet points. The third
21 bullet point reads, on average, women have 50 to
22 60 percent of men's upper arm muscle cross-sectional
23 area, 65 to 70 percent of men's thigh muscle
24 cross-sectional area, 50 to 60 percent of men's limb

1 strength and 60 to 80 of men's leg strength. Do you see
2 that language?

3 ATTORNEY BLOCK: Objection to form.

4 THE WITNESS: I do.

5 BY ATTORNEY BROOKS:

6 Q. Do you have any knowledge as to whether those
7 statistics are on correct as given by Dr. Handelsman?

8 A. I do not.

9 Q. And do you have any expert knowledge as to how
10 those statistics do or do not change under the influence
11 of testosterone suppression in natal males who
12 experience a female gender identity?

13 ATTORNEY BLOCK: Objection to
14 terminology.

15 THE WITNESS: So I guess the --- I have
16 no expert knowledge about these numbers, per se, but I
17 do know as an expert that when testosterone levels are
18 suppressed in transgender women and actually in
19 cisgender men, anyone, that these numbers are decreased.
20 And I can say that with confidence as an expert.

21 BY ATTORNEY BROOKS:

22 Q. But you're not able to quantify that decrease.
23 Is that correct?

24 A. I cannot quantify that decrease. The data gets

1 murky when we start to get there.

2 Q. Have you ever met Professor Coleman at Duke
3 University?

4 A. Doriane Coleman?

5 Q. Yes.

6 A. I have.

7 Q. And in what context have you interacted with
8 Professor Coleman?

9 A. The --- a professional context.

10 Q. Can you describe the context?

11 A. We have served on some of these --- two of the
12 same committees --- committee task force, whatever you
13 call it, for World Athletics together.

14 Q. Was she, in fact, on the committee which you
15 participated that set the five nanomolar standard for
16 the IAAF?

17 A. I don't recall for sure but I think not.

18 Q. Then can you identify for me the two committees
19 that you recall that you did sit on with Professor
20 Coleman?

21 A. Subsequent to the initial group, and I don't
22 know that it's two committees, it may be the same
23 committee, they get renamed. Things like that happen.
24 So it is --- I'm thinking forward to assisting other

1 international federations with their rule making.

2 Q. And do you consider Professor Coleman to be
3 knowledgeable about the relative athletic capabilities
4 and records of male and female athletes?

5 A. To me that's too vague a question. She's a
6 lawyer.

7 Q. Are you aware also of her athletic background as
8 a competitive athlete?

9 A. I am.

10 Q. And are you aware of her research and
11 publications having to do with athletic records and
12 capabilities of male and female athletes?

13 ATTORNEY BLOCK: Objection to form.

14 THE WITNESS: I'm aware of some of her
15 publications where she has co-authored, but she's not
16 usually the physiology expert in the group.

17 BY ATTORNEY BROOKS:

18 Q. Let me ask you to turn to paragraph 393. And if
19 you look at the page you will see that this is within
20 the tribunal summary of testimony of Professor Coleman.
21 Let me ask you since you dealt personally with the
22 professor, because I want the record to be respectful,
23 does she in general use --- prefer to be referred to as
24 Professor Lambelet-Coleman or simply Professor Coleman?

1 A. I don't know the answer.

2 Q. Okay.

3 A. I prefer to her on a first name basis.

4 Q. All right.

5 I will stick with the shorter version. In
6 paragraph 393 the panel describing Professor Coleman's
7 submission states, quote, Professor Lambelet-Coleman's
8 report compared the lifetime best performance of three
9 elite female athletes in the 400-meter event with the
10 performance of male athletes in the same event during a
11 single year, 2017, period. This showed not only that
12 the elite females would have lost to the best men by a
13 margin of about 12 percent but also that even at their
14 absolute best the elite females would have lost to
15 thousands of other boys and men by a much smaller
16 margin, closed quote. Do you see that language?

17 A. I do.

18 Q. And do you have any reason to doubt the accuracy
19 of that summary of athletic performance statistics?

20 A. I can't render an expert opinion there.

21 Q. Do you as you sit here today have any reason to
22 doubt the accuracy of those statistics?

23 A. Again, I cannot comment as an expert. I guess
24 that's the bottom line.

1 Q. If it is true that the most elite female
2 athletes performing at their absolute best would lose to
3 thousands of others boys and men. It is also true,
4 would you not agree, that the very best female college
5 athletes would lose to even a larger number of
6 collegiate boys and men?

7 A. If I'm speaking as an expert, then I'm not
8 rendering an opinion there.

9 Q. How about as a highly educated and intelligent
10 professor?

11 A. Simply in that context, it would be true that
12 --- that it would least be true at some level in the
13 elite levels of college.

14 Q. And the very best female high school athletes
15 would lose to an even larger number of high school boys.

16 Correct?

17 A. So now I can render a little bit of an expert
18 comment, which is that as you move down that line, the
19 degree of difference falls because the degree of
20 testosterone impact on body is evolving across those
21 ages.

22 Q. If it's true that the world fastest female
23 athletes would lose to thousands of boys and men then it
24 is inevitably true, is it not, Doctor Safer, to say that

1 the very best female high school athletes would lose to
2 even larger numbers of high school boys?

3 ATTORNEY BLOCK: Objection to form.

4 THE WITNESS: So the --- it is the coils
5 here. So it would be larger numbers of cisgender men in
6 general, including people who are older than they are,
7 but I'm not sure where that would be going.

8 BY ATTORNEY BROOKS:

9 Q. Let me take you back to your expert report,
10 Exhibit 1, and take you to paragraph 48. Actually, let
11 me have the Declaration, which is Tab 50.

12 ATTORNEY BROOKS: Let me mark as Safer
13 Exhibit 6 a Declaration of Dr. Safer executed in
14 May 10th, 2021.

15 ---
16 (Whereupon, Exhibit 6, 5/10/21 Declaration
17 of Dr. Safer, was marked for
18 identification.)

19 ---

20 BY ATTORNEY BROOKS:

21 Q. And I apologize, it's paragraph 50. Dr. Safer,
22 did you, in fact, prepare and execute this Declaration
23 in the time leading up to May 26, 2021?

24 A. Yes.

1 Q. And you state in paragraph 48 that, quote, age,
2 grade competitive sports records show minimal or no
3 difference in athletic performance between
4 non-transgender boys and non-transgender girls before
5 puberty, and you cite Handelsman, the article that we
6 have been looking at.

7 Correct?

8 A. Yes.

9 Q. And what research did you do to arrive at the
10 conclusion that age grade competitive sports records
11 show minimal or no difference in athletic performance
12 between non-transgender boys and non-transgender girls?

13 A. Is the question of original research on my part?

14 Q. No, what steps did you take to arrive at that
15 conclusion?

16 A. Reading relevant literature.

17 Q. You cited only Professor Handelman's 2018
18 article. Did you read other literature that gave you
19 comfort that is a true statement?

20 A. I have read other literature, but I would
21 suggest that Doctor Handelsman gave --- Doctor
22 Handelsman's paper is the best summary of the point.

23 Q. And again, in making this statement, what did
24 you consider to be a minimal difference?

1 A. When I'm thinking about this as a scientist it
2 is a difference where I'm not sure if it is true or
3 whether it is significant when defining the word
4 minimum.

5 Q. You just defined minimal by using the work
6 significant. You force me to ask you what do you mean
7 by significant?

8 A. Sorry. So as a scientist --- well, there are
9 two definitions of significant. So the one is that it
10 is relevant for those --- for decision makers. And that
11 actually gets outside of my expertise. And then we do
12 use it as a term of art in science as well.

13 Q. You meant statistically significant?

14 A. The second would be statistically significant,
15 that's right.

16 Q. Dr. Safer, you deleted that sentence from your
17 expert report.

18 Is that correct?

19 A. I have to look.

20 Q. I don't mean it to be a trick question. Let me
21 ask you this. Do you recall removing that sentence as
22 you revised your Declaration to create your expert
23 report?

24 A. No.

1 Q. All right.

2 A. I don't recall.

3 Q. We will just move on to the science and not ask
4 you deleted the question. Let me take you to paragraph
5 44 of your expert report, Exhibit 1. And just to be
6 sure, you are on the expert report now and not the
7 Declaration? They are so similar that it is easy to get
8 confused.

9 A. Yes.

10 Q. Paragraph 44 you say in the second sentence,
11 increased testosterone begins to affect athletic
12 performance at the beginning of puberty, but those
13 effects continue to increase each year of puberty until
14 about 18, with the full impact of puberty resulting from
15 the cumulative effect of each year. Do you see that
16 language?

17 A. I do.

18 Q. And just to clarify, in making this statement
19 what do you refer to as, quote, the beginning of
20 puberty? And we're talking about male typical puberty
21 in this discussion so as to clarify. So what do you
22 have in mind as the beginning of male puberty?

23 A. So the answer is complex. The typical male
24 puberty is defined as beginning with what we label as

1 Tanner 2. And in terms of when you would see impact on
2 athletic performance, per se, is not well established.

3 Q. And now stretching that in both directions, on
4 the one hand Tanner Stage 2, if I'm correct, is
5 essentially defined as certain first observable physical
6 changes in a boy's body.

7 Right?

8 A. Tanner 2 is specifically defined as specific
9 observable changes in a person's body, yes.

10 Q. And therefore, testosterone levels have begun to
11 increase even before the first observable changes that
12 result.

13 Correct?

14 A. The way it's understood in medicine is it is
15 reflective of existing reality. So it is not
16 necessarily --- you know, only in the absolute.

17 Q. Well, as a medical doctor, you would agree with
18 me or would you not that testosterone levels must
19 increase in the body before observable changes in the
20 body caused by testosterone can be --- can come about?

21 ATTORNEY BLOCK: Objection to the form.

22 THE WITNESS: So it must be the case that
23 the testosterone levels would have to rise prior to
24 their having a noticeable effect, that is true.

1 BY ATTORNEY BROOKS:

2 Q. Cause has to precede effect?

3 A. Cause in this case has to precede effect,
4 exactly. But I caution that it is not clear that that's
5 something that we could parse out medically in a given
6 person in a reasonable way. That is I don't know that I
7 could do a blood test and catch it as it were.

8 Q. Okay.

9 Can you explain to me what you were referring
10 to when you mentioned the cumulative effect of pubertal
11 changes at the end of that sentence?

12 A. Where are we now?

13 Q. We are in the second sentence of paragraph 44 of
14 Exhibit-1. And you say at the end with a full impact of
15 puberty resulting from the cumulative effect of each
16 year, and if you would explain for the Court what you
17 meant by cumulative effect that would be helpful.

18 ATTORNEY BLOCK: Objection to form.

19 THE WITNESS: So the testosterone has
20 impact on certain tissues, and then it continues to have
21 impact on tissues. And I don't know that I have any
22 greater explanation for the right cumulative impact.

23 BY ATTORNEY BROOKS:

24 Q. So your point is that by the age of 18 whatever

1 advantages in athletic performance a particular male has
2 is due to body changes that have happened each year
3 since puberty began, not due simply to the testosterone
4 level of that individual at age 18?

5 ATTORNEY BLOCK: Objection to form.

6 THE WITNESS: The meaning isn't as --- I
7 guess I would be careful about overstating it, so there
8 can --- there might be some impact earlier and then
9 there might be additional impact over time, but --- and
10 so in the absolute it would be true to say that all of
11 the effect doesn't occur at Tanner 5, which is the
12 defined end.

13 BY ATTORNEY BROOKS:

14 Q. Okay.

15 The cumulative physiological changes that you
16 are referring to here result from a multi-year history
17 of male typical levels of testosterone by age 18.

18 Correct?

19 A. Yes. Well, even that is --- there's complexity
20 but yes.

21 Q. You say --- sorry, we are jumping back and
22 forth.

23 A. Actually, just continuing a little bit further,
24 it's also about age 18 is not a trivial word.

1 Q. Understood. And I simply used that as a
2 representative end marker and for some individuals it
3 would be earlier and for some individuals it would be
4 later.

5 Correct?

6 A. That's right, even with the college athletes.

7 Q. You state at the beginning of paragraph 44 that,
8 quote, the concerns that animated the World Athletics
9 and prior IOC policies are even more attenuated for
10 students in the middle of high school where athletes
11 typically range from 11 to 18.

12 Do you see that?

13 A. I do. Was this paragraph 44?

14 Q. It is. And by attenuated you mean the same in
15 nature but smaller in scale.

16 Correct?

17 ATTORNEY BLOCK: Objection to form.

18 THE WITNESS: Yeah, I can't even say that
19 so --- yeah, I can't ---.

20 BY ATTORNEY BROOKS:

21 Q. Isn't that what attenuated means?

22 ATTORNEY BLOCK: Objection to form.

23 THE WITNESS: Attenuated is both in scale
24 and type in this case.

1 BY ATTORNEY BROOKS:

2 Q. All right.

3 You are not here or anywhere denying that the
4 same type of concern, that is physiological advantages,
5 exist at for instance age 15?

6 ATTORNEY BLOCK: Objection to form.

7 THE WITNESS: So sorry, say that again.

8 BY ATTORNEY BROOKS:

9 Q. You are not in this paragraph or anywhere
10 offering an opinion that the same type of concerns, that
11 is physiologic or in performance advantages, exist to
12 some degree at, for instance, age 15?

13 ATTORNEY BLOCK: Objection to form.

14 THE WITNESS: I'm not offering an opinion
15 there, that's right.

16 BY ATTORNEY BROOKS:

17 Q. And the same is true at age 13?

18 ATTORNEY BLOCK: Objection to form.

19 THE WITNESS: I'm not --- so I guess as
20 we --- as you move along to the continuum, then ---.

21 BY ATTORNEY BROOKS:

22 Q. It gets more attenuated?

23 A. The opinion --- right, the opinion shifts
24 because it depends on context.

1 Q. In paragraph 49 of your expert report you write
2 in the third full sentence, quote, West Virginia
3 categorically prevents girls who are transgender from
4 participating on girls teams regardless of whether they
5 are prepubertal, receiving puberty blockers, or
6 receiving gender-affirming hormone therapy, closed
7 quoted. Do you see that?

8 A. I do.

9 Q. What in your opinion is the significance of that
10 statement? What is your point?

11 ATTORNEY BLOCK: Objection. Could you
12 just give him some time to read the context?

13 BY ATTORNEY BROOKS:

14 Q. Yes.

15 A. So I guess I maybe make the --- help me with
16 where you're going with that question. I'm --- the rule
17 as written includes all transgender girls.

18 Q. Are you --- did you mean to suggest that medical
19 science would dictate that the West Virginia law should
20 make an exception for natal males who have
21 suppressed puberty?

22 ATTORNEY BLOCK: Object to form.

23 THE WITNESS: The context for the --- the
24 context of different transgender girls with different

1 degrees of treatment and different stages of puberty are
2 different. I guess that's as much I would say. I'm not
3 expressing an opinion about what the --- I'm serving
4 here just as a scientist in terms of what the --- what
5 the --- what we know about athleticism.

6 BY ATTORNEY BROOKS:

7 Q. You are not offering an opinion that either
8 science or reasonableness requires that West Virginia's
9 laws make an exception for natal males who have
10 suppressed puberty?

11 ATTORNEY BLOCK: Objection to form.

12 THE WITNESS: I'm not offering an opinion
13 that that would be --- that would be a logical law for
14 transgender girls in that circumstance.

15 BY ATTORNEY BROOKS:

16 Q. And in the article that we began today looking
17 at you expressed concern about policies that would
18 create incentives for children to begin puberty
19 blockers, would you not?

20 ATTORNEY BLOCK: Objection to form.

21 THE WITNESS: So earlier in my --- I
22 reference that as a concern. I want to be clear that as
23 an expert I'm not suggesting that --- I'm not suggesting
24 an expert opinion that these needs to be concerns. I'm

1 raising the issues that we are considering.

2 BY ATTORNEY BROOKS:

3 Q. Well, what you wrote to educate your colleagues
4 as an endocrinologist, you, Professor Safer, raise that
5 as a concern?

6 ATTORNEY BLOCK: Objection to form.

7 THE WITNESS: To be clear, I raised it as
8 a concern of the community. I did not take an opinion
9 in that article that it was a concern that I was
10 offering as an expert.

11 BY ATTORNEY BROOKS:

12 Q. Well, let me ask you as a medical doctor sitting
13 here today, an endocrinologist, it would cause you
14 concern, would it not, that policies are adopted that
15 created incentives for children to start puberty
16 blockers when they might otherwise not choose to do so?

17 ATTORNEY BLOCK: Objection to form and to
18 scope.

19 THE WITNESS: It's too broad of a
20 question as you're asking it because there is certainly
21 --- in medicine it is certainly the case that we fear
22 coercing people to certain treatments and certain
23 circumstances but they are certainly alternate examples
24 where we very much coerce people to have certain medical

1 interventions. And so as an expert I have no opinion,
2 as we said already. And simply as somebody trying to be
3 logical and thoughtful I can come up with examples in
4 both certain circumstances.

5 BY ATTORNEY BROOKS:

6 Q. I'm going to ask you to take Exhibit-6 --- no,
7 Exhibit 4, the Handelsman article if you would.

8 A. Yes.

9 ATTORNEY TRYON: Roger, would you speak
10 up a little more, please? And Josh, when you shuffle
11 your papers, it really garbles the testimony. If you'd
12 be a little more careful about that, I'd appreciate it.

13 ATTORNEY BLOCK: Sorry.

14 ATTORNEY BROOKS: It's a crowded table
15 and we have papers bumping up against the mic. So just
16 call out if we do that wrong.

17 BY ATTORNEY BROOKS:

18 Q. So Dr. Safer, you pointed to the Handelsman
19 article as the best source on the proposition --- on the
20 question to what extent if any natal male has
21 physiological or I should say athletic performance
22 advantages over natal females before puberty.

23 Correct?

24 ATTORNEY BLOCK: Objection to

1 terminology?

2 THE WITNESS: And if I said the word best
3 maybe that's not the best way of saying it, but it's a
4 very clean, well-written summary of the circumstance.

5 BY ATTORNEY BROOKS:

6 Q. At any rate, it's the one that you chose to
7 cite?

8 A. And it is the one that I chose to cite.

9 Q. I'm going to give you a three by five card to
10 help read a chart that doesn't have grid lines on it so
11 you have a straight edge. And I want to take you in
12 Handelsman's 2018 article, Exhibit 4, to page 813 and
13 figure one. And you've familiar with this figure and
14 these curves, are you not?

15 A. I am, yes.

16 Q. When you studied this article carefully this is
17 part of what you studied.

18 Right?

19 A. It is.

20 Q. And these charts show percentage performance
21 advantage of males over females and just to simplify
22 terminology I believe there's nothing in here about
23 dealing with transgender individuals in these charts.
24 So with your permission I'll simply use male and female

1 to be the dare I say simple biological designations as
2 we had previous discussions. Is that acceptable?

3 A. I think so.

4 Q. If it's something that comes up ---.

5 A. I will mention it, yes.

6 Q. I don't think it will in this discussion. First
7 of all, would you agree with me that, generally
8 speaking, junior high contemplates grades 7 through 9
9 and commonly ages in the range of 12 to 15?

10 ATTORNEY BLOCK: Objection to form.

11 THE WITNESS: Junior high is grades 7
12 through 9. It used to be. Now there is Middle School.

13 BY ATTORNEY BROOKS:

14 Q. I know?

15 A. Exactly.

16 Q. Let's just work with you and I are of general
17 age. So Junior High is 7 to 9?

18 A. Okay.

19 Q. And in your general understanding, this is
20 layman's stuff, not expert stuff, that is ages 12 to
21 15-ish?

22 A. Let's see, seven --- let me think about this.
23 Right, 15 at about the max, right, because there is
24 about 14.

1 Q. And high school is 14, 15 through age 18-ish.
2 Some people graduate at age 17?

3 A. Yes. As a non-expert I would believe, yes.

4 Q. All right.

5 And this chart charts the percentage advantage
6 enjoyed --- on average enjoyed by males over females in
7 three different events at over --- on a year by year
8 basis from ages 10 up to 19.

9 Am I describing it correctly?

10 ATTORNEY BLOCK: Objection to form. Just
11 for the record, it's percentage differences, not
12 percentage advantages.

13 BY ATTORNEY BROOKS:

14 Q. Correct, it says --- it says gender difference
15 percentage to read the Y axis.

16 A. Clear, yes.

17 Q. Okay.

18 So let's look at running and you have your
19 straight edge if it is helpful to you. At age 12, what,
20 according to Dr. Handelsman, is the gender difference in
21 running performance?

22 A. So in this paper there is a range. But just to
23 help you get to your point faster I guess we can --- it
24 is about five percent of tab over.

1 Q. And for reasons best known to Professor
2 Handelsman, his arrow bars extend only upwards, correct,
3 in this chart?

4 A. Right. I will have to attribute that to
5 cleanliness of the figure.

6 Q. Or if he has chosen to fit his curve to the
7 bottom end of this error range possibly?

8 ATTORNEY BLOCK: Objection to form.

9 THE WITNESS: Yeah, I can't comment
10 there, but that wouldn't be usual.

11 BY ATTORNEY BROOKS:

12 Q. That would not be usual, I agree. And what
13 advantage --- what gender difference between male and
14 female does Professor Handelsman report at age ten
15 approximately?

16 A. At age ten in the particular figure that we are
17 referencing it is --- the average is --- well, actually,
18 so here it ranges from about two percent because that is
19 probably how the air bars are meant to be up to just a
20 little north to three percent.

21 Q. And going back to age 12, do you consider a five
22 percent difference between male and female performance
23 to be minimal?

24 ATTORNEY BLOCK: Objection to form.

1 THE WITNESS: So the problem here with
2 going right to this figure is it's including a range of
3 inputs, and so this is --- so these are what are called
4 cross-sectional studies, and so the --- if your question
5 is just in the narrow point of this five percent
6 minimal, well, even there I don't know that I can
7 comment because it depends on how broad the variation is
8 among the group.

9 BY ATTORNEY BROOKS:

10 Q. And what gender difference did Dr. Handelsman
11 report in running at age 15?

12 A. At age 15, a range that is hovering about 9 to
13 10 percent.

14 Q. And by age 15, according to his sample, the
15 gender difference is approached --- begins to level off.
16 In other words, it has --- most of the gender difference
17 has been achieved at age 15.

18 Correct?

19 ATTORNEY BLOCK: Objection to form.

20 THE WITNESS: Among this data in this
21 study set, yes, I will agree with you it does level off.

22 BY ATTORNEY BROOKS:

23 Q. So let me ask you this. Do you have an
24 understanding of the physiological basis of what you

1 described as a two to three percent male advantage at
2 age ten in running?

3 ATTORNEY BLOCK: Objection to form.

4 BY ATTORNEY BROOKS:

5 Q. If any?

6 A. So speaking as an expert, there's no --- there
7 is no physiological --- there is no expectation of a
8 physiological explanation. And there is awareness of
9 other confounders in terms of experience, exposure to
10 sport and things like that.

11 Q. Let me ask you to look at jumping, at age ten.
12 And this is --- at age ten what performance of gender
13 difference advantage did Dr. Handelsman report for boys
14 in jumping?

15 A. So at age ten it would go on --- so at age ten
16 then the range ---.

17 Q. This by the way tells us that he cannot be
18 inclined in arrow bar --- a symmetrical arrow bar below.
19 Correct?

20 ATTORNEY BLOCK: Objection to form.

21 THE WITNESS: So he can't. In fact, the
22 range that he's showing there goes from an advantage for
23 girls --- that is it goes below to an advantage --- for
24 boys. The range is included and it just --- for both

1 sexes.

2 BY ATTORNEY BROOKS:

3 Q. So what is the average advantage that he reports
4 at age ten for boys?

5 A. So in this dataset the average is about a six
6 percent average for boys, but it is important to
7 understand the data. And the data that --- the point
8 being that if we were to repeat the study you would
9 anticipate that that average would fall across those
10 entire --- the entire range shown so that in a different
11 day it might show a bigger advantage for boys, but a
12 different day it might also show an advantage for girls
13 about higher.

14 Q. Are you aware of any dataset that shows a
15 smaller advantage in jumping for girls at age ten?

16 A. Off the top of my head I cannot guide --- lead
17 you to a dataset.

18 Q. At age 12 what advantage in jumping --- well,
19 let me start over. At age 12 what advantage in jumping
20 does Dr. Handelsman report for boys?

21 A. So in this dataset at age 12 he shows the
22 advantage --- the average advantage to be of the less
23 than the average advantage for age ten, but this exactly
24 points to the caution that I was referencing, which is

1 that the range of possibilities that you might
2 anticipate based on this particular dataset at age 12
3 has a range of four to six percent advantage for boys.

4 Q. The arrow bar has tightened up a lot?

5 A. The arrow bar in that age range is tighter.

6 Q. And do you consider a six percent advantage to
7 be minimal?

8 ATTORNEY BLOCK: Objection to form.

9 THE WITNESS: As an expert I can't answer
10 that because it depends on context on the heterogeneity
11 of all these events.

12 BY ATTORNEY BROOKS:

13 Q. And at age 15 what average advantage in jumping
14 did Dr. Handelsman report for boys?

15 A. For age 15 he has a range or the average sits at
16 15 percent and the range runs from about 14 percent to
17 maybe 17 percent.

18 Q. Is there any context in your opinion, any
19 athletic endeavor that involves jumping in which a 15
20 percent advantage is in your view minimal?

21 ATTORNEY BLOCK: Objection to form.

22 THE WITNESS: Yes, I think as an expert I
23 can't answer that. If you're thinking at the scholastic
24 level where there is a wide range of --- where there's a

1 quite wide range of heterogeneity in development, body
2 type, et cetera, I certainly could envision a situation,
3 yes.

4 BY ATTORNEY BROOKS:

5 Q. Dr. Safer, in your Declaration filed in May you
6 stated that before puberty athletic advantage by boys
7 was minimal. Do you recall that language?

8 A. The way I would say it is the difference between
9 boys and girls before puberty is minimal or
10 non-existent. I don't know if I could be wiser than
11 that.

12 Q. All right. But now you are telling me when I
13 asked you questions about minimal that you as an expert
14 are not able to define minimal. How do you reconcile
15 those two?

16 ATTORNEY BLOCK: Objection to form.

17 THE WITNESS: So the definition of
18 minimal is in context. And so as we discussed it was
19 not a significant difference using both those
20 definitions that we already used were no different at
21 all.

22 BY ATTORNEY BROOKS:

23 Q. Your statement in your Declaration simply
24 asserted categorically in almost no context that the

1 difference in athletic capability of boys to girls were
2 both minimal. My question for you is using whatever
3 definition you had in mind when you wrote that do you
4 consider a --- I will look at jumping, a five percent
5 difference in capability to be minimum?

6 ATTORNEY BLOCK: Objection to form and
7 characterization of the report.

8 THE WITNESS: So it's a context. So in
9 the report the reference is to prepubertal children.
10 And there it is easier to be more categorical. Where
11 now we're moving into an area where there is --- where
12 things are more complex and so it is a harder context to
13 make that statement.

14 BY ATTORNEY BROOKS:

15 Q. That is a sample of ten-year old boys includes
16 some who are no longer prepubertal.

17 Correct?

18 A. No. I'm saying it more the other way, which is
19 a sample of ten-year-old boys would overwhelmingly be
20 prepubertal but a sample of 15-year-old boys would have
21 more of a range and have more heterogeneity. And
22 there's more to it even than that, which is the
23 definition of minimal also includes the context of the
24 entire population who participated in the sport.

1 Q. So focusing on ten-year-old boys and jumping you
2 said at age ten the large majority of boys are,
3 according to your definition, prepubertal. Referring
4 back to Declaration and the meaning that you ascribed to
5 the word minimal there, in your view, is a six-percent
6 difference in capability minimal or not minimal?

7 ATTORNEY BLOCK: Objection to form and to
8 talking about his Declaration without it being in front
9 of him.

10 ATTORNEY BROOKS: He has it in front of
11 him and we already looked at the language.

12 BY ATTORNEY BROOKS:

13 Q. You may answer.

14 A. So the graph that we are looking at includes
15 arrow bars that include the possibility that boys would
16 have --- that the girls would have a superior outcome,
17 and so the answer then becomes, yes. Where the data are
18 either small or are suspect or not significant, then all
19 of that collectively certainly is --- would be included
20 as minimal to non-existent.

21 ATTORNEY BROOKS: Let me mark as Exhibit
22 Safer 7 a paper by Emma Colton and Tommy Lundsburg
23 entitled Transgender Women in a Female Category of
24 Sport, from 2021, previously marked as Exhibit 13 at Dr.

1 Adkins's deposition.

2 ---

3 (Whereupon, Exhibit 7, Transgender Women In
4 a Female Category of Sport, was marked for
5 identification.)

6 ---

7 BY ATTORNEY BROOKS:

8 Q. And first, Professor Safer, let me ask whether
9 you're familiar with this paper published last year?

10 A. I am familiar.

11 Q. And have you interacted professionally with
12 either Dr. Colton or --- and I don't know his degree,
13 Mr. Lundsburg in any context?

14 A. Here I don't remember.

15 Q. Okay.

16 Do you believe that you became aware of this
17 paper soon after it was published?

18 A. I don't know if I can answer that cleanly
19 either, but I certainly have become aware of it
20 somewhere between then and now.

21 Q. And have you read it with some care?

22 A. I have read it with some care, yes.

23 Q. Let me ask you --- well, let me ask you this
24 first. Would you describe this paper as reporting

1 original research or as more of a literature review
2 paper?

3 A. I don't recall them reporting on their original
4 research, but I would have to look. It's mostly a
5 review paper.

6 Q. That is also my impression. I just didn't want
7 to create a different impression. Let me ask you to
8 turn to page 201, and there in the first column
9 beginning six lines down there is a sentence that begins
10 an extensive review. Let me ask you to find that.

11 A. I have it.

12 Q. And that --- I'll read it into the record.
13 Quote, an extensive review of fitness data from over
14 85,000 Australian children age 9 to 17 years old showed
15 that compared with nine-year-old females, nine-year-old
16 males were faster over short sprints, 9.8 percent, and
17 one mile, 16.6 percent, could jump 9.5 percent farther
18 from a standing start, which tested explosive power,
19 could complete 33 more push-ups in 30 seconds and have
20 13.8 percent stronger grip. Male advantage of a similar
21 magnitude was detected in a group study of children
22 where compared to a six-year old females six-year old
23 males competed 16.6 percent more shuttle runs in a given
24 time and could jump 9.7 percent further from a standing

1 position. Do you see that language?

2 A. I do.

3 Q. And on the Australian study, if you follow the
4 footnote you will see that it references a study by
5 Kaitlin Thompson. That's footnote 22. And my first
6 question is have you read the reference study by Kaitlin
7 Thompson?

8 A. I don't recall. I'm guessing yes.

9 Q. All right. All right.

10 Do you have any reason to doubt the accuracy of
11 this summary of the findings of Kaitlin Thompson
12 based on data from over 85,000 Australian children?

13 ATTORNEY BLOCK: Objection to form.

14 THE WITNESS: I think the important thing
15 to recognize when you look at these sorts of data are
16 recognizing the multiple inputs. So the larger these
17 groups --- these cross-sectional studies get the more
18 confounded they get by access and other social
19 explanations why there are boys participating in sports
20 to a greater degree.

21 BY ATTORNEY BROOKS:

22 Q. So putting aside causation, which might be
23 physiological and might be cultural, as you said there
24 could be various causes, do you have any reason to doubt

1 the accuracy of the findings of performance advantage
2 summarized here in the passage that I've just read?

3 ATTORNEY BLOCK: Objection to form and
4 terminology.

5 THE WITNESS: Putting aside causation, I
6 have no --- I can't offer an expert opinion I guess if
7 that's the bottom line. But if you're asking me just as
8 an individual, I'm not expecting that they're
9 fabricating that data. I am not expecting that.

10 BY ATTORNEY BROOKS:

11 Q. And you agree that advantages on a scale of 9
12 percent, 16 percent could provide a significant
13 advantage in athletic competition, do you not?

14 ATTORNEY BLOCK: Objection to
15 terminology.

16 THE WITNESS: So say that question again.

17 BY ATTORNEY BROOKS:

18 Q. You agree that advantages on the scale of
19 9.8 percent or 16.6 percent would provide a large
20 advantage in athletic competition, do you not?

21 ATTORNEY BLOCK: Same objection to
22 terminology.

23 THE WITNESS: In elite athletic
24 competition, yes.

1 BY ATTORNEY BROOKS:

2 Q. Did you play any sport in high school?

3 A. At a sophisticated level I did not.

4 Q. Your general knowledge permits you to say, does
5 it not, that at the high school level also a 9.8 percent
6 or a 16.6 percent advantage is a very large advantage?

7 ATTORNEY BLOCK: Objection to form and
8 terminology?

9 THE WITNESS: So there it gets more
10 diffuse, therefore, and I can't answer as an expert.

11 BY ATTORNEY BROOKS:

12 Q. Can you answer as an informed adult citizen?

13 ATTORNEY BLOCK: Same objection.

14 THE WITNESS: So as an expert for sure
15 not. As an informed adult, it falls back to the same
16 situation. When there is a wide range of athletes in a
17 certain context, then it is going to seem less relevant.
18 And obviously with the example I gave before with an
19 elite circumstance where that --- it describes the
20 entire field is more significant.

21 BY ATTORNEY BROOKS:

22 Q. Let me ask you to find your rebuttal report.

23 A. And actually --- do others need a break?

24 Q. Any time --- your concentration is most

1 important. So if you need a break, we'll take a break.

2 A. So I'm good.

3 ATTORNEY BROOKS: Well, obviously, if
4 anybody wants a break, we can take a break.

5 ATTORNEY BLOCK: Do you need a break?

6 ATTORNEY SWAMINATHAN: No.

7 ATTORNEY BLOCK: We are good.

8 THE WITNESS: So my rebuttal.

9 BY ATTORNEY BROOKS:

10 Q. Your rebuttal, which is Exhibit 2, so it's
11 probably at the bottom. And in that I'm going to draw
12 your attention to paragraph 11. And there you wrote
13 there is also no basis to confidently predict the
14 patterns about the athletic performance of prepubertal
15 cisgender boys will be the same for prepubertal
16 transgender girls, closed quote. Do you see that?

17 A. I do.

18 Q. And let me attempt to see if I understand the
19 point of this paragraph. And indeed, if you would like
20 to read the whole paragraph you should. But my
21 understanding of the point is that you're saying that
22 even if prepubertal boys have some performance, some
23 statistically significant performance advantage over
24 prepubertal girls, that you are not confident that the

1 athletic performance capabilities of natal males who
2 identify as females before puberty will be the same as
3 those of natal males who identified as male before
4 puberty?

5 ATTORNEY BLOCK: Objection to the
6 terminology.

7 THE WITNESS: So to the extent --- so
8 were differences to be determined between cisgender boys
9 and cisgender girls, it is correct to say that that
10 won't conclusively demonstrate that the same applies for
11 transgender girls. That's right.

12 BY ATTORNEY BROOKS:

13 Q. Now, elsewhere in your writings you have said
14 that it is well known that the majority of prepubertal
15 children who experience gender dysphoria do not persist
16 in that dysphoria into pubertal adolescence.

17 Correct?

18 ATTORNEY BLOCK: Objection.

19 THE WITNESS: No.

20 BY ATTORNEY BROOKS:

21 Q. Not correct?

22 A. Not correct.

23 Q. Then we will come back to that. In this
24 paragraph 11, you speculate a little farther down that,

1 quote, the experience of transgender girls might be more
2 similar to the experience of cisgender girls?

3 ATTORNEY BLOCK: Objection to the
4 characterization and speculative.

5 BY ATTORNEY BROOKS:

6 Q. Well, by using the word might you meant to
7 indicate, did you not, Dr. Safer, this is a hypothesis,
8 this is not a documented fact?

9 A. That if the question is do I know that the
10 experience of transgender girls is definitely in this
11 circumstance the same as cisgender girls, that's right,
12 I don't know that. It only might be true.

13 Q. And towards the end, in the last line, you refer
14 to potential biological underpinnings of gender
15 identity. Again, the word potential signaling that no
16 such specific underpinnings have yet been identified.

17 Correct?

18 A. Say that question again.

19 Q. In the last line, your reference to, quote,
20 potential biological underpinnings of gender identify,
21 by the word potential you are indicating that no
22 specific biological underpinning has yet been
23 identified.

24 Correct?

1 ATTORNEY BLOCK: Objection to form.

2 THE WITNESS: So it's --- so no,
3 potential in this context does reference that most of
4 this biology is unknown, so that part is true, but it
5 doesn't mean that there is nothing known.

6 BY ATTORNEY BROOKS:

7 Q. You do not propose to offer any opinion that
8 natal males --- let me strike that and start again.

9 You do not propose to offer any opinion, do
10 you, that prior to puberty natal males who identify as
11 female are less athletic capable on average than natal
12 males who identify as male?

13 ATTORNEY BLOCK: Objection to form.

14 THE WITNESS: I'm not offering an opinion
15 with regard to cisgender --- excuse me --- cisgender
16 boys versus transgender girls and their athleticism when
17 they are prepubertal. If that's what you are asking,
18 then yes, I'm not offering an opinion between those two
19 groups. I'm simply raising the possibility that
20 something like biology associated with transgender could
21 have influence into it.

22 BY ATTORNEY BROOKS:

23 Q. Let me ask you to turn to paragraph 22 of your
24 rebuttal report. And there you write Doctor Brown also

1 refers to widely publicized anecdotes about isolated
2 cases of transgender girls and women state championships
3 in high school sports or NCAA championships in college.
4 Do you see that?

5 A. I do.

6 Q. And you go on to write but transgender athletes
7 of women have been competing in NCAA and secondary
8 school athletics for many years at this point, closed
9 quote. Do you see that language?

10 A. I do.

11 Q. Let me ask you to name all instances of male
12 males known to you who have competed in women's division
13 varsity athletics in any athletic endeavor for any NCAA
14 member school?

15 ATTORNEY BLOCK: Objection to form and
16 scope.

17 THE WITNESS: Right, so I certainly can't
18 do that usefully off the top of my head, name
19 transgender women and all these context in such an
20 exhaustive way like that.

21 BY ATTORNEY BROOKS:

22 Q. Well, I asked you accused Doctor Brown of citing
23 isolated cases. Do you have any basis to assert that he
24 has done anything other than cite all cases in which

1 natal males have competed in NCAA athletics in the
2 female category?

3 A. So the --- if our focus is on the word isolated
4 then per se they are all --- these are all isolated
5 cases. These aren't systematic analyses of any cohort
6 of people.

7 Q. You are not accusing Doctor Brown of picking and
8 choosing?

9 ATTORNEY BLOCK: Objection to form.

10 THE WITNESS: So let me think about that.

11 By simply choosing individual cases that are in the
12 press then it is by its nature picking and choosing.

13 BY ATTORNEY BROOKS:

14 Q. What do you mean by that?

15 A. Well, these are simply individual cases that
16 have --- that have come to public attention, and so I
17 --- so --- and that's the basis of my statement as
18 opposed to some exhaustive attempt to identify
19 transgender people in a systematic fashion.

20 Q. As you sit here today, Dr. Safer, are you aware
21 of a single case not mentioned by Doctor Brown in his
22 report of a natal male who has competed in NCAA
23 athletics in the women's category?

24 ATTORNEY BLOCK: Objection to form.

1 THE WITNESS: Can I name somebody off the
2 top of my head? I cannot.

3 BY ATTORNEY BROOKS:

4 Q. Do you have any concrete --- leaving aside
5 whether you remember a precise name, do you have any
6 factual basis to know that Doctor Brown has omitted any
7 case of a natal male who has competed in the female
8 division of NCAA athletics?

9 ATTORNEY BLOCK: Objection to form.

10 THE WITNESS: So I guess if the question
11 is what can I do off the top of my head, then I cannot.

12 BY ATTORNEY BROOKS:

13 Q. Off the top of your head, you recall the case of
14 June Eastwood, do you not?

15 A. You have to remind me what that is.

16 Q. A runner in Montana?

17 A. I actually would need to be reminded of those
18 details.

19 Q. All right. Certainly you recall Lia Thomas
20 because none of us can mis Lia Thomas these days?

21 A. Lia Thomas is still in the news.

22 Q. Do you recall the case of CeCe Telfer?

23 A. Names are not my strength.

24 Q. All right. No more on that.

1 You say at the end of this paragraph, quote,
2 the occasional championship that has been widely
3 publicized do not come close to constituting the rates
4 one would expect if they, that is transgender athletes,
5 wanted rates that are proportional to their overall
6 percentage of the population, which is approximately one
7 percent. Do you see that language?

8 A. I do.

9 Q. Do you have any knowledge as to what --- first
10 of all, let me ask, what is your basis for believing
11 that the current student population in college and high
12 school level is approximately one percent transgender?

13 A. The statistic for the percentage of the
14 population who are transgender comes from surveys.

15 Q. And do you have any knowledge at all as to what
16 percentage of varsity athletes in America today at the
17 NCAA --- among NCAA member schools in the women's
18 division are transgender?

19 A. If the question is that a survey in that
20 population, I'm not aware of a survey that's been done.

21 Q. So you don't know whether the number of
22 victories of championships that have been taken in the
23 women's division by transgender competitors is higher or
24 lower than the percentage of athletes in those divisions

1 who are transgender?

2 ATTORNEY BLOCK: Objection to form.

3 THE WITNESS: That is correct. I do not
4 know the percentage that --- what we know is the
5 percentage of transgender people and then we know the
6 percentage of identified athletes winning competitions.
7 And even then we don't know that absolutely. We only
8 know the ones that are publicized. But, right, in the
9 in between, we don't have statistics. That's right.

10 ATTORNEY BROOKS: Counsel, I'm going to
11 suggest --- in my experience, if we break for lunch at
12 noon, it makes it a little long afternoon. So I would
13 suggest that we take a short break now and then keep
14 going until like 12:45 or something. It's seven hours
15 on the clock and I'm here just to tell you that the
16 afternoon gets long. So unless you are starving I'd
17 recommend ---?

18 THE WITNESS: No, I think that's a great
19 idea.

20 ATTORNEY BROOKS: Take a short break now.

21 THE WITNESS: So you don't know who is on
22 the phone so give them a break.

23 ATTORNEY BROOKS: Let's go off the
24 record.

1 VIDEOGRAPHER: Going off the record. The
2 current time reads 12:01:00 p.m. Eastern Standard Time.
3 OFF VIDEOTAPE

4 ---
5 (WHEREUPON, A SHORT BREAK WAS TAKEN.)

6 ---
7 ON VIDEOTAPE

8 VIDEOGRAPHER: Back on the record.
9 Current time reads 12:14 p.m. Eastern Standard Time.

10 ATTORNEY BROOKS: Let me mark as Safer
11 Exhibit 8 the Endocrine --- Treatment of Gender
12 Dysphoric Gender Incongruent Persons, an Endocrine
13 Society Clinical Practice Guidelines from 2017
14 previously marked as Adkins Exhibit 4.

15 ATTORNEY WILKINSON: Tab 5.

16 ---
17 (Whereupon, Exhibit 8, Endocrine Society
18 Guidelines, was marked for identification.)

19 ---

20 BY ATTORNEY BROOKS:

21 Q. And Doctor Safer, am I correct you served the
22 committee that created this revised version of the
23 Endocrine Society's Guidelines?

24 A. Yes.

1 Q. And is it reasonable for me to assume therefore
2 that you are familiar with it in some detail?

3 A. I am familiar with it in some detail.

4 Q. They also pertain to your practice?

5 Am I correct.

6 A. And they do pertain to my practice, yes.

7 Q. Let me ask you to turn in Exhibit-5 to Page 3879
8 --- Exhibit 8, 3879. And there I will call your
9 attention to the specific recommendation that's numbered
10 1.4. And it says there we recommend against puberty
11 blocking and gender-affirming hormone treatment in
12 prepubertal children with GD/gender incongruence.

13 Do you see that?

14 A. I do.

15 Q. And then there is a section headed evidence,
16 right?

17 A. Yes.

18 Q. And the first statement in the sentence that is
19 --- in the section headed evidence is, quote, in most
20 children diagnosed with GD/gender incongruence it did
21 not persist into adolescence, closed quote.

22 Do you see that?

23 A. I do.

24 Q. Do you believe that to be a false statement?

1 A. I wouldn't --- I guess it depends on context
2 here too. So as of when this was written, the
3 literature being referenced had a broader diagnosis for
4 gender dysphoria and gender incongruence or really
5 gender dysphoria is the label that was being used and
6 still is. Gender incongruence is where we are headed.
7 And so with that broader definition, that included
8 gender expansive children who were not necessarily
9 transgender.

10 Q. The statement is I think fairly specific. And
11 as you are aware, the discussion cites various
12 references, but the introductory sentence states in most
13 children diagnosed with GD a gender dysphoria or gender
14 incongruence did not persist into adolescence. Do you
15 believe to be a true statement or false statement?

16 ATTORNEY BLOCK: Objection to form.

17 THE WITNESS: The problem is I can't
18 answer that quite that cleanly. The statement
19 references a circumstance that I just referenced where
20 children receiving that label have to --- for the most
21 part were not transgender. The only caution I want to
22 make is that as we grow more refined in our
23 understanding of gender identity and also in our
24 labeling, that we are more specific in identifying

1 transgender kids with these sorts of labels.

2 BY ATTORNEY BROOKS:

3 Q. Well, recommendation 1.4 says we recommend
4 against puberty blocking and a gender hormone treatment
5 in prepubertal children with gender dysphoria or gender
6 incongruence. Do you have an understanding of why these
7 Endocrine Society guidelines of which you're a co-author
8 recommended against puberty blocking in prepubertal
9 children?

10 A. Yes.

11 Q. Why?

12 A. They have no impact.

13 Q. Can you point me to anywhere in the evidence
14 discussion that suggests that is the reason for this
15 recommendation?

16 A. I don't know. Let me look.

17 Q. The evidence discussion is just two paragraphs.

18 ATTORNEY BLOCK: I just want to object to
19 the extent you're limiting his review to the evidence
20 section.

21 BY ATTORNEY BROOKS:

22 Q. My question pertains to the evidence section.

23 A. So those two paragraphs are both primarily
24 referencing 1.3 and not 1.4.

1 Q. Well, let me ask you to turn to page 3881. And
2 at the top of that first column on 3881 it reads we,
3 therefore, advise starting suppression in early puberty
4 to prevent irreversible development of undesirable
5 secondary sex characteristics. However, comma,
6 adolescents with gender dysphoria, slash, gender
7 incongruence should experience the first changes of
8 their endogenous puberty because their emotional
9 reaction to these first physical changes has diagnostic
10 value in establishing the persistence of gender
11 dysphoria/gender incongruence.

12 Do you see that language?

13 A. I do.

14 Q. And as a scientist and practitioner do you agree
15 with that statement?

16 A. I would say that the validity of that statement
17 is in evolution.

18 Q. In your practice, over time --- well, let me ask
19 you this. When this was drafted did you raise an
20 objection to the proposition that the child's emotional
21 reaction to the first physical changes of puberty had
22 important diagnostic value?

23 A. I cannot recall our specific conversations, but
24 if you're asking if my view has shifted since let's say

1 2015, 2016, 2017, no, the recognition that there is an
2 evolution was already part of my opinion.

3 Q. What do you mean the recognition that there is
4 an evolution about?

5 A. So the evolution is that whether there is a need
6 to start puberty as a diagnostic --- as a necessary
7 diagnostic circumstance.

8 Q. In your practice today do you prescribe puberty
9 blockers prior to Tanner Stage 2?

10 A. I --- so two things. My practice is with
11 adults. And although I will see older kids because I
12 don't have a hard threshold of age 18, but I don't
13 prescribe puberty blockers because I don't --- my
14 practice does not include those age children. But two,
15 it is still the guidance and so the pediatricians who
16 are part of my program do not prescribe puberty blockers
17 prior to Tanner 2 for the reason I stated initially.

18 Q. And according to these guidelines, by the time
19 you reach Tanner Stage 2 there have been sufficient
20 first pubertal --- stages of pubertal development to
21 give a chance to observe the child's reaction to
22 pubertal changes for diagnostic purposes.

23 Correct?

24 ATTORNEY BLOCK: Objection to form.

1 THE WITNESS: So the --- so I guess there
2 are kind of two pieces. The sentence is --- that
3 sentence is written, but that is the sentence that I'm
4 suggesting is an opinion that is in evolution, like I'm
5 saying, to whether that need really exists or not. The
6 reason why we still don't prescribe puberty blockers
7 before Tanner 2 is that there is no point, there is no
8 preventive element to puberty blockers and so there is
9 no point to give them before puberty begins and there is
10 no way to know that until there is an observable
11 objective finding.

12 Q. Has your own practice ever involved to a
13 significant extent treating prepubertal or early
14 pubertal stage children for gender dysphoria or gender
15 incongruence incongruence?

16 A. Have I personally cared for prepubertal children
17 who are transgender or otherwise? Actually, in the
18 subjects, no.

19 Q. And do physicians who do treat prepubertal
20 children report to you in connection with your position
21 at the clinic or the Mount Sinai Medical Hospital?

22 A. Yes.

23 Q. And do you know whether your clinic makes use of
24 children's emotional reactions to the first physical

1 changes of puberty as part of their process of
2 determining whether transgender hormonal therapies of
3 any sort are appropriate for that child?

4 A. Yeah, I can't give you give you an answer. I
5 would actually have to go survey my psychologists.

6 Q. Let me direct you to paragraph 17 of your
7 rebuttal report. And there you say in the second
8 sentence under current standards of care transgender
9 adolescents are eligible to receive puberty blockers
10 when they reach Tanner 2, not Tanner 3, which is early
11 enough to prevent endogenous puberty from taking place,
12 closed quote.

13 Do you see that?

14 A. I do.

15 Q. Now, just for context, you testified previously
16 that the large majority of minors I'll say who present
17 with gender incongruence or gender dysphoria are, in
18 fact, considerably older and have gone through at least
19 most of the Tanner stages.

20 Correct?

21 ATTORNEY BLOCK: Objection to
22 characterization.

23 THE WITNESS: Most of the people we are
24 seeing in clinical practice are coming to us at later

1 stages of development, yes.

2 BY ATTORNEY BROOKS:

3 Q. And so when we talk about prepubertal children,
4 we're talking about a small minority of the patients
5 coming in to ---?

6 A. I can't define small, but it is the minority,
7 that's correct.

8 Q. And do you believe that what your clinic is
9 seeing in that regard is typical of what's being seen
10 across the country these days?

11 A. So if I'm sitting here as an expert, I don't
12 have an expert survey to point to, to give you an answer
13 there.

14 Q. But you read the literature and you talk to
15 colleagues at other institutions.

16 Am I correct?

17 A. I certainly both read the literature and talk to
18 colleagues.

19 Q. And is it your current belief that what you are
20 seeing in terms of the breakdown of patient population
21 is similar to or quite different from what other major
22 gender clinics are experiencing?

23 A. So kind of separating, I'm living in my expert
24 role, I really want to point to data where I have any

1 confidence at all, and I have none. If you are asking
2 me in a more informal way among our conversations, then
3 I can answer that our experience seems similar to
4 others' experience.

5 Q. All right.

6 So in talking about prepubertal children ---
7 well, strike that. We've been through that.

8 In your rebuttal report when you said beginning
9 puberty blockers at Tanner stage 2 is early enough to
10 prevent endogenous puberty from taking place, let me ask
11 you, in consideration, do you believe it is accurate as
12 stated?

13 A. So Tanner 2 early enough to prevent endogenous
14 puberty from taking place, yes, that is accurate.

15 Q. You would agree with me, would you not, that the
16 endocrine guidelines of which you are a co-author
17 recommend to treat beginning puberty blockers at Tanner
18 Stage 2?

19 A. So to clarify, under the cited guidelines what
20 they say the recommendation is do not use puberty
21 blockers prior to puberty beginning, prior to Tanner 2.

22 Q. Let me direct you to recommendation 2.2 on
23 page 3880. Recommendation 2.2 reads we suggest the
24 clinicians begin pubertal hormone suppression after

1 girls and boys first exhibit physical changes of
2 puberty.

3 Do you see that?

4 A. I do.

5 Q. And then it says, paren, Tanner stages G2/B2
6 which is to say the girls Tanner 2 or boys Tanner 2,
7 correct?

8 A. That is what that means, yes.

9 Q. So the official recommendation from the
10 Endocrine Society is begin at or after Tanner Stage 2,
11 right?

12 ATTORNEY BLOCK: Objection to form.

13 THE WITNESS: That is a correct.

14 BY ATTORNEY BROOKS:

15 Q. And it says that Tanner Stage 2 is defined as
16 girls and boys first exhibiting physical changes of
17 puberty.

18 Correct?

19 ATTORNEY BLOCK: Objection to form.

20 THE WITNESS: The definition of Tanner 2,
21 is where there is any objective evidence when puberty
22 has begun.

23 BY ATTORNEY BROOKS:

24 Q. So in fact, beginning puberty blockers at Tanner

1 Stage 2 does not categorically prevent endogenous
2 puberty from taking place but instead prevents a
3 substantial portion of endogenous puberty from taking
4 place.

5 Correct?

6 ATTORNEY BLOCK: Objection to form.

7 THE WITNESS: So let me ---.

8 BY ATTORNEY BROOKS:

9 Q. It is in paragraph 17.

10 A. So the --- I guess the way this is understood is
11 --- I guess it depends on how extreme you want to take
12 things. It is back to our original conversation of that
13 cause has to take place before effect. So it's parsing
14 it to that degree.

15 In a biological context it really is the case
16 that we need some objective evidence before we begin
17 things so that we don't make the mistake of using a
18 medication prior to its having any impact. And then
19 it's also true that some of the hormone mediated changes
20 that we see do actually regress to that prepubertal
21 state when we --- when you use puberty blockers at
22 Tanner 2. So the statement as written --- as I wrote it
23 is accurate in the way we think of these things in
24 biology.

1 Q. Although the guidelines specifically state that
2 adolescents should --- before puberty blockers, quote,
3 should experience the first changes of their endogenous,
4 spontaneous puberty. And the recommendation calls for
5 beginning puberty blockers, quote, after girls and boys
6 first exhibit physical changes at puberty, paren, Tanner
7 stages 2, closed paren. I'm not misreading anything, am
8 I?

9 ATTORNEY BLOCK: Objection to just
10 reading an excerpt.

11 THE WITNESS: Right. I don't know --- I
12 don't know if those were are all direct quotes or not so
13 I won't comment on whether you're misreading or not, but
14 the first statement that you reference, as I've said, is
15 one where there is an evolving understanding of its
16 veracity or its applicability.

17 The statement 2.2 is simply using
18 alternate phrasing for saying Tanner 2, that is we need
19 to have objective evidence that puberty is genuinely
20 beginning. The focus and the purpose of these
21 statements is to avoid people using puberty blockers on
22 non-pubertal kids.

23 BY ATTORNEY BROOKS:

24 Q. Well, you would agree with me, would you not,

1 that if one administer puberty blockers in accordance
2 with Endocrine Society guidelines, then some stages of
3 endogenous male puberty will have occurred in natal male
4 patients?

5 ATTORNEY BLOCK: Objection the form.

6 THE WITNESS: So when we are ---
7 specifically we're referencing transgender girls here.
8 And although pre-pubertis gender boys, when we see
9 Tanner 2, then some --- some degree of development has
10 taken place. That part is true. So in the absolute
11 sense, then yes. But in a biological sense, like I said
12 already, the --- some interesting reality is that some
13 of that does regress.

14 BY ATTORNEY BROOKS:

15 Q. By the way, you, yourself, do not have any
16 knowledge as to what developments of endogenous male
17 puberty BPJ underwent prior to initiating puberty
18 blockers, do you?

19 A. I have had no physical contact with BPJ.

20 Q. Nor have you studied BPJ's chart sufficiently to
21 be feel that you know the answer to that question?

22 A. Right, I'm not expressing any opinion to the
23 specific medical terms, that's right.

24 Q. Have you, yourself, ever supervised any

1 research, clinical research, concerning treatment of
2 prepubertal children for gender dysphoria or gender
3 incongruence?

4 A. Have I supervised research on treatment of
5 prepubertal transgender girls? Let me think about that.
6 Nothing is coming to mind, but our program does do
7 research across an age span.

8 Q. Well, some of your colleagues might have done
9 such research, but my question is whether you have been
10 personally supervised or involved in such research?

11 A. I'm pretty involved actually, especially in our
12 research program, but I'm having a difficult time coming
13 up with an example.

14 Q. All right.

15 I just want to make sure I know about it if it
16 exists.

17 A. Yes.

18 ATTORNEY BROOKS: Let me mark as Safer
19 Exhibit 9 an article entitled --- an article or a
20 chapter or something entitled Care of the Transgender
21 Patient dated 2019 by Dr. Safer and by Doctor Vin
22 Tangpricha.

23 ---

24 (Whereupon, Exhibit 9, Care of the

1 Transgender Patient Article, was marked
2 for identification.)

3 ---

4 BY ATTORNEY BROOKS:

5 Q. Am I correct that this is --- well, you tell me,
6 is this an article or book chapter? How would you
7 describe this document?

8 A. This is a review article from the Annals of
9 Internal Medicine.

10 Q. And by review you mean it's not reporting on
11 original research but rather summarizing the state of
12 knowledge in a particular area?

13 A. That is correct.

14 Q. Okay.

15 And the pages may have ITC and a number, but
16 I'll just refer to the number if I may. On page three,
17 column two, is a statement that I think is just
18 repeating what you told me, that is most --- quote, most
19 transgender persons present to clinicians in late
20 adolescence or adulthood, closed quote. That is
21 consistent with what you testified earlier.

22 Correct?

23 A. That is, yes.

24 Q. And if you turn then to page five, column two,

1 you write in the first full sentence in column two,
2 prior effects of androgens on the skeleton height and
3 size and shape of the hands, feet, jaw and pelvis and
4 voice, including visibly --- visible laryngeal
5 prominence, will not be altered if treatment is
6 initiated after puberty.

7 Do you see that language?

8 A. I do.

9 Q. And is it consistent with your understanding
10 that at this stage also changes to the size of the heart
11 and the lungs will not be altered if testosterone is
12 commenced after the initiation of puberty?

13 A. Not quite.

14 Q. Explain that to me, please.

15 A. So transgender women, if they have gone through
16 a typical male puberty, are going to remain larger, but
17 the testosterone has action on certain tissues, so
18 specifically muscle, and that --- when those
19 testosterone levels shrink, then that muscle shrinks and
20 the heart muscle is --- well, the heart is a muscle, so
21 it will be --- there will be an impact from body size,
22 but there will also be impact from the lower level of
23 testosterone. So it will be kind of a mix of those two.

24 Q. The heart is a muscle but it has in it cavities

1 of a certain size in which blood flows, out of which
2 blood is pumped, correct? Do you have any knowledge,
3 are you aware of any literature that documents that
4 testosterone suppression reduces the heart's pumping
5 capacity?

6 ATTORNEY BLOCK: Objection to form.

7 THE WITNESS: So the --- so there is a
8 gap there of transgender research --- so no, that is
9 something that's not been studied.

10 BY ATTORNEY BROOKS:

11 Q. And the lungs are not muscle tissue. Are you
12 aware of any science that indicates or even suggests to
13 you as an expert that an individual who has gone through
14 typical male puberty, that individual's lungs reduce in
15 size if testosterone is suppressed?

16 A. So the answer with regard to lungs is going to
17 have some of those same inputs as heart or other tissues
18 actually where overall size of the individual is not ---
19 well, certainly height at least is not decreasing, and
20 so this person is larger. And so lung size matches that
21 to some degree. And testosterone has some impact on
22 surrounding muscle. And so to the degree that that
23 shrinks there might be lung shrinking too. And so you
24 hear that --- that is going to be a complex answer. And

1 in terms of interpreting it even, you then would also
2 have to interpret it in the context of the size of the
3 body if you want to consider function, and none of this
4 has been studied.

5 Q. Certainly you don't believe, do you, that an
6 individual who has been --- let me start that again. It
7 is not your opinion, is it, that testosterone
8 suppression by an individual who has been through a
9 typical male puberty reduces that individuals VO2 mass
10 to typical female levels?

11 A. So the more we get into some of the subtler
12 physiology, I will take a step back and give you an
13 expert opinion, but I will --- in addition to that point
14 out that we don't even have studies on this. We're just
15 at a stage of beginning to look at that sort of thing.

16 ATTORNEY BLOCK: Roger, are you able to
17 speak up a little?

18 ATTORNEY BROOKS: I will try.

19 BY ATTORNEY BROOKS:

20 Q. You state that in paragraph 55 of your expert
21 report, Exhibit 1?

22 A. So paragraph 55.

23 Q. Fifty-five (55). You state that there are,
24 quote, only two studies examining the effect of

1 gender-affirming hormone therapy on athletic
2 performance, closed quote. Do you see that?

3 A. Yes.

4 Q. You are aware, are you not, that there are a
5 substantially larger number of studies that examine the
6 effect of testosterone suppression on strength or muscle
7 mass in natal males?

8 ATTORNEY BLOCK: Objection to form.

9 THE WITNESS: There are --- there are a
10 handful of studies on the impact of testosterone
11 lowering treatment on transgender women on some tissues,
12 yes.

13 BY ATTORNEY BROOKS:

14 Q. Well --- and not to get carried away with the
15 terminology, there are also studies that relate to
16 application of testosterone suppression to males who
17 don't identify as transgender, are there not?

18 A. To cisgender men in addition to transgender
19 women there are some studies --- yes, there are actually
20 some modest studies, yes, on cisgender men.

21 Q. And have you now taken some care to review
22 yourself all the peer-reviewed studies of that type that
23 were cited in Doctor Brown's report?

24 A. I have looked at papers that were cited by

1 Doctor Brown. The moment we use the word all I
2 hesitate, but certainly I've read through the papers
3 that were cited.

4 ATTORNEY BROOKS: Well, let's start with
5 one you referenced, article by Roberts, et al., from
6 2020, which I will mark as Exhibit --- Safer Exhibit-10.

7 COURT REPORTER: 10.

8 ATTORNEY WILKINSON: 10, Tab 60.

9 ---

10 (Whereupon, Exhibit 10, Roberts, et al,
11 Articles, was marked for
12 identification.)

13 BY ATTORNEY BROOKS:

14 Q. And in fact, this is one of only very few
15 articles that you cite in your expert report start to
16 finish.

17 Correct?

18 ATTORNEY BLOCK: Objection to form.

19 THE WITNESS: So this paper is referenced
20 to an expert report.

21 BY ATTORNEY BROOKS:

22 Q. Let me direct you to the last page of your
23 expert report where there is a bibliography. And other
24 than citing to your own writings as the entire basis of

1 your opinions you cited only six articles.

2 Correct?

3 ATTORNEY BLOCK: Objection to
4 characterization about its entire cases for his
5 opinions.

6 THE WITNESS: So the paper specifically
7 referenced two reviews and six papers but recognized
8 that some of these papers specifically are summaries of
9 the topic.

10 BY ATTORNEY BROOKS:

11 Q. You have studied the Roberts 2020 article with
12 some care.

13 Is that correct?

14 A. I have indeed, yes.

15 Q. And so far as you know it is the only
16 longitudinal study of the impact of testosterone
17 suppression in natal males and actual athletic
18 performance and in this case running.

19 Correct?

20 ATTORNEY BLOCK: Objection to form.

21 THE WITNESS: So the Roberts study and
22 the Harper study are both studies of transgender women
23 with at least two time points.

24 BY ATTORNEY BROOKS:

1 Q. The Harper study is strictly retrospective, it
2 is not a prospective, longitudinal study?

3 A. The Harper study is --- that's a good question.
4 I actually don't know if it is --- it's probably mixed,
5 honestly.

6 Q. Well, we can look at it, but it is not mixed.
7 It is a one-time survey.

8 A. Well, to be clear, the way we phrase these
9 things sometimes are --- I'm trying to be --- are
10 according to certain conventions academically, so that
11 sometimes it will be framed that way because from an
12 academic perspective we'll use that context, but I think
13 some of the data was actually collected in both
14 collections.

15 Q. The Roberts study you understand to be a
16 prospective, longitudinal study, do you not?

17 A. Well, actually, you are testing me on that. Did
18 they set out at the beginning to do it or did they go
19 back and look? I'd have to see.

20 Q. Well, based on the method, I think the answer is
21 they went back and looked because it begins we reviewed?

22 A. Yes.

23 Q. Do you --- is it your opinion that amongst the
24 available data, the Roberts study is --- on the impact

1 of testosterone on athletic performance is some of the
2 strongest data that we have available?

3 ATTORNEY BLOCK: Objection to form.

4 THE WITNESS: It is my opinion that the
5 Roberts and Harper studies are the only two studies that
6 we have available.

7 BY ATTORNEY BROOKS:

8 Q. Is it your opinion as an expert, is it not, that
9 the structure of the Roberts study renders it --- and
10 the source of its data renders it far more reliable than
11 the Harper 2015 study?

12 ATTORNEY BLOCK: Objection to form.

13 THE WITNESS: I would not overstate that,
14 so no. If I'm being --- if I'm being professorial and
15 saying this is how to organize something, then in that
16 context I might say that, but in terms of simply
17 believability of data, I got two modest papers that are
18 the sum of the world literature on the subject.

19 BY ATTORNEY BROOKS:

20 Q. You say in paragraph 56 of your report that
21 Roberts found, quote, after two years of
22 gender-affirming hormone therapy transgender women
23 completed the 1.5 mile run 12 percent faster on average
24 than non-transgender women, closed quote. Do you see

1 that?

2 ATTORNEY BLOCK: I think he needs some
3 time to get ---.

4 THE WITNESS: Yeah, to actually find
5 the ---.

6 BY ATTORNEY BROOKS:

7 Q. Paragraph 56. And I will refer you to the third
8 sentence.

9 A. All right.

10 Sorry say that again.

11 Q. I'm simply calling your attention to the place
12 where you wrote at the Roberts report that after two
13 years of a gender-affirming hormone therapy transgender
14 women completed the 1.5 mile run 12 percent faster on
15 average than non-transgender women.

16 A. Yes.

17 Q. And two years, not a trick question here, twice
18 as long as the one year testosterone suppression
19 requirement that led to the NCAA rule.

20 Correct?

21 A. Two years is twice one year, yes.

22 Q. And you would agree with me that a 12 percent
23 faster in women's time is a substantial advantage?

24 ATTORNEY BLOCK: Objection to form.

1 THE WITNESS: So this is a bit --- this
2 is a bit of the same conversation. I guess I can't say
3 that in a blanket way. It depends on context.

4 BY ATTORNEY BROOKS:

5 Q. The context here is that that these are all Air
6 Force members, do you recall?

7 A. I believe they are all Air Force members, yes.

8 Q. All subject to Air Force physical fitness
9 requirements. So we are not talking about couch
10 potatoes?

11 A. I'm not rendering an opinion there as an expert.

12 Q. Generally you would accept that this is a
13 relatively fit population?

14 A. I can't even render an opinion there as an
15 expert.

16 Q. Do you have some unhealthy relative who's a
17 member of the armed forces?

18 A. I was in the National Guard, so I do have some
19 insight.

20 Q. Okay.

21 You would agree, would you not, that running
22 speed and endurance, per se, are relevant to quite a
23 number of sports?

24 A. Running speed and endurance are relevant to many

1 sports. I'm certain that is true. I'm not ---

2 Q. Well ---.

3 A. --- an expert again.

4 Q. I'm no sports fan, but we've all seen enough
5 sports to know there's a lot of running involved not
6 just in track but in basketball, soccer, lacrosse and
7 field hockey.

8 Correct?

9 A. I have observed that, yes. But again, I'm not
10 rendering an expert opinion there, but yes.

11 Q. And on page six of this paper ---.

12 A. This is Roberts.

13 Q. Yes, Roberts and Exhibit 10. Roberts and his
14 co-authors summarize in their conclusion by stating,
15 quote, in this study we confirm that the use of gender
16 affirming hormones are associated with changes in
17 athletic performance and demonstrated that the
18 pretreatment differences between a transgender and a
19 cisgender woman persist beyond the 12-month time
20 currently --- requirement currently being proposed for
21 athletic competition by the World Athletics and the IOC.
22 Do you see that?

23 A. This is the conclusion section?

24 Q. It is.

1 A. Yes, I see that.

2 Q. And you don't have any expert opinions that the
3 findings of Roberts are inaccurate or unreliable, do
4 you?

5 A. So the --- this is again a question of context.
6 So I have no reason to suspect that these data are
7 suspect. The only question then is what we conclude
8 when you do a study of --- for the transgender women I
9 think we are talking about 29 people, which I certainly
10 like a lot better than simply pointing to a random
11 individual, but I recognize as also simply 29
12 individuals in a certain circumstance that might or
13 might not be replicated as we do this again and increase
14 the numbers of people that we evaluate.

15 Q. You don't propose to offer any expert opinion
16 that the findings of Roberts as reported in this paper
17 of 2020 are inaccurate?

18 A. So, I guess the way I said it is how I said it
19 already, which is I'm not doubting Roberts' data, but I
20 wouldn't then over generalize to say that I know that
21 these would be the findings we would see in every
22 similar circumstance.

23 Q. And are you aware that one common track event or
24 cross-country event, I can never keep them straight, is

1 the 1600 meter, which is about a mile?

2 A. Actually, that is not my expertise. I believe
3 you.

4 Q. Are you aware that the 3,000 meter, a 1.8 mile
5 distance, is a standard event?

6 A. If you are meaning to quiz me on the standard
7 lengths these days and meters and all of that, no.

8 ATTORNEY BROOKS: Well, I can't complete
9 my next document in two minutes, we if we want to break
10 at 1:00 now or I can do one more document.

11 ATTORNEY BLOCK: I'm fine continuing if
12 you are.

13 THE WITNESS: My bias is to push.

14 ATTORNEY BROOKS: Folks online, we're
15 going to continue a little bit farther.

16 BY ATTORNEY BROOKS:

17 Q. You cited a paper by Harper from 2015. And that
18 paper also I take it you studied with some detail?

19 A. Yes.

20 Q. And how many individuals did Harper have in that
21 study?

22 A. I --- do we have her ---?

23 Q. Everything that you mention I have.

24 ATTORNEY BROOKS: Let me mark as Safer

1 Exhibit 11 ---

2 ATTORNEY WILKINSON: Yes.

3 ATTORNEY BROOKS: --- Harper's --- Harper
4 et al. or just Harper, article Race Times for
5 Transgender Athletes from 2015.

6 ATTORNEY WILKINSON: Tab 61.

7 ---

8 (Whereupon, Exhibit 11, Race Times for
9 Transgender Athletes Article, was marked for
10 identification.)

11 ---

12 THE WITNESS: Thank you.

13 BY ATTORNEY BROOKS:

14 Q. You say you have worked with Joanna Harper, you
15 are aware that Dr. Harper is both an athlete and
16 transgender?

17 ATTORNEY BLOCK: Objection to form.

18 THE WITNESS: I am aware. I am aware
19 that she is an athlete, and I'm aware that she is
20 transgender.

21 BY ATTORNEY BROOKS:

22 Q. Did you have after studying the paper end up
23 with an understanding of how many participants there
24 were?

1 A. There were eight participants. I'm looking at
2 Table 5.

3 Q. Did you have an understanding of how those
4 participants were recruited?

5 A. I do have some understanding of that, yes.

6 Q. How is that?

7 A. The --- how would I characterize this? It's
8 somewhat ad hoc in the sense that Ms. Harper is in the
9 category of these other participants, and so she was
10 able to identify others that met the criteria of being
11 both transgender and being sufficiently intense in their
12 middle distance running that they had race times that
13 they could identify that would allow for the --- for
14 these determinations of age based --- I don't know all
15 the terminology here, but their age-based grade
16 proportional to others in that same sex category.

17 Q. And it is consistent with your understanding, is
18 it not, that all of the information in this study about
19 what hormonal treatment these individuals had undergone
20 was self reported?

21 A. This is --- the entire study is self report,
22 that is she didn't have --- Ms. Harper did not have
23 access to people's individual records independently.

24 Q. So there was no independent confirmation of how

1 long that they had suppressed testosterone.

2 Correct?

3 A. There was no independent confirmation beyond Ms.
4 Harper and her dealing with other subjects directly.

5 Q. Well, in your view as a scientist, that's not
6 independent confirmation, is it?

7 ATTORNEY BLOCK: Objection to form.

8 THE WITNESS: So I'm not expressing an
9 opinion there because in a science --- you know, in a
10 scientific paper we would have --- we would have peer
11 review, but we don't --- that just --- ends up being a
12 little bit of a fuzzy realty.

13 BY ATTORNEY BROOKS:

14 Q. There is no information in this paper about what
15 testosterone levels were achieved by any of these
16 individuals as a result of suppression, is there?

17 A. I don't know. Let's --- I can look through that
18 a little bit because does she reference how many of them
19 have had surgery and such? It has been quite a while,
20 you know. So notably, there is some independent
21 confirmation of some of the data because some of this
22 was posted.

23 Q. Wait. Let me just be clear. Some of the times
24 were verified independently.

1 Correct?

2 A. That's correct.

3 Q. Nothing about the hormonal treatment?

4 A. Right.

5 ATTORNEY BLOCK: Do you want to give him
6 a chance to review it?

7 BY ATTORNEY BROOKS:

8 Q. Doctor Safer, let me just withdraw that question
9 and ask you another question.

10 A. Yeah, go ahead.

11 Q. Do you know whether Doctor Harper stands behind
12 the conclusions of her 2015 paper today?

13 A. If you ask me do I know it, that's too strong a
14 statement.

15 ATTORNEY BROOKS: Let me mark as Safer
16 Exhibit 12 an article by Joanna Harper and others from
17 2021 entitled How Does Hormone Transition in Transgender
18 Women Change Body Composition, Muscle Strength and
19 Hemoglobin.

20 ATTORNEY WILKINSON: Tab 21.

21 ---

22 (Whereupon, Exhibit 12, Joanna Harper
23 Article, was marked for identification.)

24 ---

1 BY ATTORNEY BROOKS:

2 Q. Dr. Safer, have we put that in front of you?

3 Yes, we have. Are you familiar with this article?

4 A. I am.

5 Q. And have you read it, reviewed it recently?

6 A. I have reviewed it relatively recently.

7 Q. And do you understand, and I didn't completely
8 read the title. The second sentence of the title says
9 Systematic Review with the Focus on Implications for
10 Sport Participation.

11 Do you see that?

12 A. I do.

13 Q. Can you tell me why when you cited Harper's 2015
14 paper that you just referred to as older science you
15 didn't cite Harper's 2021 publication?

16 A. So to be clear, I didn't use the older science.
17 I simply referenced Harper's paper as one of the only
18 two papers on the subject. And your question?

19 Q. Why didn't you cite Harper's 2021 paper on the
20 topic?

21 A. So this paper is more in the category of the
22 papers looking at impact on tissues of which there are
23 several papers as opposed to actually investigating a
24 specific activity, a person's activity. And does this

1 have primary data in it?

2 Q. Well, let me take you to page eight.

3 A. Yeah, I don't even think this has a final data
4 in it.

5 Q. Describing the Roberts study, Harper here on
6 page eight, column one, about halfway down, summarizes
7 as follows: Quote, trans women ran significantly faster
8 during the 1.5 mile fitness test than ciswomen. These
9 observations in trained transgender individuals are
10 consistent with the finding of the current review in
11 untrained individuals whereby 30 months of gender
12 affirming hormone therapy maybe sufficient to attenuate
13 some but all influencing factors associated with
14 muscular endurance and performance, closed quote.

15 Do you see that?

16 A. Yes. This is the end of the paragraph there?

17 Q. Yes.

18 A. We're starting with these observations, yes, I
19 see that.

20 Q. And do you propose to offer any expert opinion
21 inconsistent with Joanna Harper's summary of the data
22 here suggesting that 30 months of gender affirming
23 hormone therapy may be sufficient to attenuate some but
24 not all influencing factors associated with muscular

1 endurance and performance?

2 A. The statement here is too broad, so it's simply
3 raising questions.

4 Q. Well, Joanna Harper says here that the findings
5 of her current review were that 30 months of gender
6 affirming hormone therapy may be sufficient to attenuate
7 some but not all influencing factors associated with
8 muscular endurance and performance?

9 ATTORNEY BLOCK: Objection to leaving out
10 words of what you quoted.

11 BY ATTORNEY BROOKS:

12 Q. And my question for you is do you intend to
13 offer an expert opinion that you believe is inconsistent
14 with that statement?

15 ATTORNEY BLOCK: Same objection. It's
16 misquoting the document.

17 THE WITNESS: So the operative or
18 inoperative word here is may be sufficient, and so when
19 we're --- these are research questions as we try to
20 understand physiology and the relevance of certain
21 testosterone levels at certain endpoints and then not
22 just endpoints as surrogates, which is what most of the
23 papers to date still are, but endpoints in actual
24 athleticism and athletic competition. And so that's all

1 this is doing is putting out some questions or some
2 potential thoughts.

3 BY ATTORNEY BROOKS:

4 Q. Let me ask you to turn to page one and column
5 one.

6 A. Of this same paper?

7 Q. Of the same paper. In the conclusion of the
8 abstract the last sentence reads, quote, these findings
9 suggest the strength may be well be preserved in trans
10 women during the first three years of hormone therapy,
11 closed quote.

12 Do you see that?

13 A. I do.

14 Q. And having reviewed whatever literature you have
15 reviewed to date do you share Doctor Harper's
16 understanding that strength may well be preserved in
17 trans women during the first three years of hormone
18 therapy?

19 ATTORNEY BLOCK: Objection to misquoting
20 the document.

21 THE WITNESS: So I can't comment on Ms.
22 Harper's understanding, but if you're asking is that ---
23 you know, is the question a question, so the question is
24 a question. These findings suggest that strength may

1 and again an operative word is may.

2 BY ATTORNEY BROOKS:

3 Q. Yes.

4 A. And these are as I, a scientist, and she is a
5 scientist too, we are turning the earth, as it were, of
6 what we know looking for what questions we might want to
7 study and how we might want to frame studies going
8 forward.

9 Q. Let me take you back to page eight, if I may.
10 And the penultimate sentence of this paper at the bottom
11 of the first column of paragraph of page eight reads,
12 quote --- well, let me read --- yeah, I will just read
13 that, quote, whether transgender and cisgender women can
14 engage in meaningful sport even after gender affirming
15 hormone therapy is a highly debated question, closed
16 quote.

17 Do you see that language?

18 A. I do.

19 Q. You'll agree that up to the present that is a
20 highly debated question?

21 ATTORNEY BLOCK: Objection to form.

22 THE WITNESS: There's context there too.

23 So this is referencing a league sport and it's --- as
24 well there are a range of potential sports, and so the

1 question and the degree to which it is highly debated
2 even I'm not going to render an official opinion there.
3 So the --- whether transgender and cisgender women can
4 engage in meaningful sport depends on what sport we're
5 talking about, what treatment we're talking about, age
6 group, whether elite versus more of an intermural
7 setting. And so it's just a relatively simple statement
8 and to summarize a paper I guess.

9 BY ATTORNEY BROOKS:

10 Q. You agree that this --- that is the question of
11 whether transgender and cisgender women can engage in
12 meaningful sport even after gender affirming hormone
13 therapy is one on which reasonable scientists can
14 disagree and today are disagreeing?

15 ATTORNEY BLOCK: Objection to form.

16 THE WITNESS: So going back --- so is
17 your --- so are you asking me --- I guess help me
18 reframe what the question is there because there are a
19 bunch of things packed into that sentence actually. And
20 you heard me try to unpack them both.

21 BY ATTORNEY BROOKS:

22 Q. That may be a complex question, as debated
23 questions often are, but my question is do you agree
24 that the question of whether transgender and cisgender

1 women can engage in meaningful sport even after gender
2 affirming hormone therapy is one on which reasonable
3 scientists can differ and are differing today given the
4 possibility of data?

5 ATTORNEY BLOCK: Objection to form for
6 the same reasons.

7 THE WITNESS: So I'm sitting here as a
8 scientist talking about differences in athleticism and
9 such and whether --- and so moving onto meaningful sport
10 goes beyond my expertise. I'm only putting data
11 together in a --- that's my lane on this subject.

12 ATTORNEY BROOKS: Okay.

13 Let's break for lunch.

14 ATTORNEY BLOCK: Let's go off the record,
15 so 2:15.

16 ATTORNEY BROOKS: 2:15? Any dissent? No
17 dissent.

18 VIDEOGRAPHER: Going off the record. The
19 current time is 1:16 p.m. Eastern Standard Time.

20 OFF VIDEOTAPE

21 ---

22 (WHEREUPON, A SHORT BREAK WAS TAKEN.)

23 ---

24 ON VIDEOTAPE

1 VIDEOGRAPHER: Back on the record. The
2 current time is 2:18 p.m. Eastern Standard Time.

3 BY ATTORNEY BROOKS:

4 Q. Good afternoon, Dr. Safer. Take you back into
5 context, I'm going to ask you to find your expert
6 report, Exhibit-1, and find paragraph 25, which we have
7 looked at before. And there in the third sentence it
8 reads based on current research comparing
9 non-transgender boys and men with non-transgender girls
10 and women before, during and after puberty the primary
11 known biological driver of these average group
12 differences is testosterone starting at puberty, and not
13 reproductive biology or genetics, period, closed quote.

14 Do you see that language?

15 A. Yes.

16 Q. And your one cite for that is the endocrine that
17 we've already looked at already.

18 Right?

19 ATTORNEY BLOCK: Objection to the form.

20 THE WITNESS: So the citation in that
21 paragraph is the Handelsman, yes.

22 BY ATTORNEY BROOKS:

23 Q. And do you recall our earlier discussion about
24 how the effects of testosterone are cumulative over time

1 rather than depending solely on the testosterone level
2 of an individual at a particular time, right? Do you
3 recall that discussion?

4 A. So the impact --- excuse me, the impact of
5 testosterone is cumulative. It depends what impacts
6 we're talking about. So there are impacts that are
7 cumulative, like height, and there are impacts that
8 really do reflect that point in time.

9 Q. Now, at the moment let me ask just based on your
10 recollection. The Handelsman article is Exhibit-4. Do
11 you have that? And I will ask you to find it in your
12 pile. I should have neated up your pile of exhibits
13 while you were out. That looks like it.

14 A. Got it, yes.

15 Q. The Handelsman article, as far as you recall,
16 does not contain any data or conclusions concerning the
17 effects of testosterone after the beginning of male
18 puberty, does it?

19 ATTORNEY BLOCK: Objection to form.

20 THE WITNESS: Honestly, I would have to
21 go look carefully.

22 BY ATTORNEY BROOKS:

23 Q. Then I won't take time to do that.

24 A. Okay.

1 Q. It does or it doesn't. We will deal with that.

2 A. Yes.

3 Q. Do you know whether any other writing Professor
4 Handelsman has expressed any view as to whether
5 testosterone suppression after male puberty eliminates
6 sex-based physical advantages sufficiently to maintain
7 fairness in sports for women?

8 ATTORNEY BLOCK: Objection to the form.

9 THE WITNESS: So first of all, putting it
10 altogether that way isn't necessarily how I would say it
11 or how I would expect it to be said. It would be
12 testosterone suppression and whatever the scientific
13 finding at the moment would be. So we already know that
14 the data that relate to athleticism are just the Roberts
15 paper and the Harper paper, so I guess that is as much
16 as I can say in that particular context. And in terms
17 of --- so yes, I think that it wouldn't be --- I forgot
18 already how you phrased that.

19 BY ATTORNEY BROOKS:

20 Q. Let me just ask again.

21 A. Yes.

22 Q. So the first question is not a hard one.

23 A. Okay.

24 Q. Do you know whether Professor Handelsman has

1 himself in his publication expressed any view whether
2 testosterone suppression after male puberty eliminates
3 sex-based physical advantages sufficiently to maintain
4 fairness in sports for women?

5 ATTORNEY BLOCK: Objection to form.

6 THE WITNESS: So I don't know if he has
7 written something covering all those bases that you just
8 described, how you described it.

9 ATTORNEY BROOKS: All right. Let's look
10 at treatment variable. Let me mark as Exhibit 13 a
11 short article by Dr. Roberts with a subsequent comment
12 by David Handelsman.

13 ATTORNEY WILKINSON: Tab 62.

14 ATTORNEY BROOKS: And unfortunately, the
15 words were a little clipped on this. We will see how we
16 do.

17 ---

18 (Whereupon, Exhibit 13, Dr. Roberts Article, was
19 marked for identification.)

20 ---

21 ATTORNEY BLOCK: Thanks.

22 BY ATTORNEY BROOKS:

23 Q. And I think a fair description of what we have
24 here is a relatively popular press type piece by Dr.

1 Roberts first. And this document is dated December 16,
2 2020.

3 ATTORNEY BLOCK: Objection. Does it say
4 where it was published?

5 ATTORNEY BROOKS: No, it doesn't say on
6 its face where it was published. And as we sit here
7 right now I don't recall, though actually looking at it
8 I do recall that Kilio is an online publication of some
9 sort, and I've seen the brand came from the Kilio
10 website.

11 BY ATTORNEY BROOKS:

12 Q. At any rate, I see the date, I see the title.
13 It purports to be an article by Professor Roberts. I
14 just want to be clear in my description it does not ---
15 it does not have the appearance of a separate peer
16 review article since the summary taken off of the
17 article that we've already looked at. And then at the
18 end of it is a two-paragraph prospective on this offered
19 by Dr. Handelsman.

20 Do you see that?

21 A. I do.

22 Q. And he begins by making clear that he is
23 commenting on this study, that is Roberts study that is
24 discussed above. He is not introducing new science,

1 correct, is that consistent with your understanding?

2 ATTORNEY BLOCK: Objection. Give him a
3 chance to read it.

4 THE WITNESS: So that, yes, my
5 understanding, too, is that there is not new data here,
6 mostly a commentary within the context some of our
7 existing knowledge on the Roberts study.

8 BY ATTORNEY BROOKS:

9 Q. And in his comment to Dr. Handelsman states in
10 the second paragraph, as of 2020, quote, a major
11 question remains whether gender affirming hormone
12 treatment overcomes sex-based physical advantages
13 sufficiently to maintain fairness so that an exception
14 can be made for trans women, paren, natal males, closed
15 paren, treated with estrogen.

16 Do you see that language?

17 A. I do.

18 ATTORNEY BLOCK: Objection. I believe
19 that is what it says, but I just want to note for the
20 record that there is text cut off on the left.

21 ATTORNEY BROOKS: There is. And I'll get
22 better copies. I'm looking at a copy that's not cut off
23 I will represent.

24 BY ATTORNEY BROOKS:

1 Q. And do you have an expert opinion as to ---
2 well, do you propose to offer any opinion disagreeing
3 with Professor Handelsman that as of 2020 it remained a
4 major question whether gender affirming hormone
5 treatment to overcome sex-based physical advantages
6 sufficiently to maintain fairness so that an exception
7 could be made for trans women treated with estrogen?

8 A. So to me that's too broad a question if you're
9 asking me to render an expert opinion about his opinion.

10 Q. I'm asking whether you propose to offer an
11 expert opinion inconsistent with his view that remains a
12 major question as of 2020.

13 A. It's --- I might --- well, I would at least
14 phrase things differently in there --- we might have to
15 go through pieces of it because certainly where we lack
16 data I think we would agree, but in terms of those
17 statements that then go on to editorialize, I don't know
18 that we necessarily agree in how we would frame that.

19 Q. A little farther down, maybe two sentences down
20 it reads, quote, by contrast, trans women treated with
21 estrogens after completing male puberty experienced only
22 minimal declines in physical performance over 12 months,
23 substantially surpassing average female performance for
24 up to eight years, closed quote. Do you agree or

1 disagree with Professor Handelsman summary of the
2 findings of Roberts?

3 ATTORNEY BLOCK: Objection to form. I'm
4 just not sure it's all based on Roberts?

5 THE WITNESS: It is not clear to me that
6 it's --- that it is based on Roberts for what it's
7 worth. It's also somewhat simplistically written. And
8 an example is we don't --- the contention with regard to
9 athletic outcomes relates more to testosterone, and so
10 saying transgender women treated with estrogens wouldn't
11 be precisely how I would frame that either.

12 BY ATTORNEY BROOKS:

13 Q. He concludes --- Professor Handelsman concludes
14 by stating supporting federations should incorporate
15 these findings in the strategies for including trans
16 women in elite female competitions while maintaining
17 fairness and safety for other women. Dr. Safer, do you
18 agree that maintaining safety for cisgender women is a
19 legitimate and indeed important concern?

20 ATTORNEY BLOCK: Objection to form.

21 THE WITNESS: As an expert I'm not going
22 to give an opinion.

23 BY ATTORNEY BROOKS:

24 Q. As Doctor Safer do you agree that ensuring

1 safety for cisgender women and girls is a legitimate
2 concern?

3 ATTORNEY BLOCK: Objection to form.

4 THE WITNESS: So if I'm simply speaking
5 not as an expert, just as an educated person in the
6 field, then it is true that safety is important, but I'm
7 not clear that --- I don't know that in most of these
8 athletic activities it's actually a concern.

9 ATTORNEY BROOKS: Let me mark as Safer
10 Exhibit 14 a document entitled Guidance with Transgender
11 Inclusion in Domestic Sport with symbols of a number of
12 UK sport governing bodies across the front and a
13 statement published September 2021.

14 ATTORNEY WILKINSON: Tab 22.

15 ---

16 (Whereupon, Exhibit 14, Guidance with
17 Transgender Inclusion in Domestic Sport,
18 marked for identification.)

19 ---

20 THE WITNESS: Thank you.

21 BY ATTORNEY BROOKS:

22 Q. And my first question for you, Dr. Safer, is
23 whether you have seen this document before?

24 A. I have seen this document before.

1 Q. And were you aware of it prior to its reference
2 in this litigation?

3 A. I don't know that I was.

4 Q. And are you familiar with the role of the
5 supporting body mentioned on the front page in
6 governance of sport within the United Kingdom?

7 A. By looking at all their logos, I cannot say that
8 I know them all, no.

9 Q. And do you have any knowledge as to whether
10 these are official government chartered --- chartered
11 sporting governing bodies?

12 A. I do not have that knowledge.

13 Q. Have you now studied this document with some
14 care?

15 A. I would say that I have only looked at this
16 document superficially. I'm certainly happy to look
17 through it.

18 Q. I will ask you just about a couple of passages.
19 Let me ask you to turn to page three of the document.
20 And towards the very bottom and the next to the last
21 paragraph this --- five organizations states, quote, our
22 work exploring the latest research, evidence and studies
23 made clear that there are retained differences in
24 strength, stamina and physique between the average women

1 compared with the average transgender women for
2 nonbinary person registered male at birth with or
3 without testosterone suppression.

4 Do you see that language?

5 A. I do.

6 Q. And do you disagree with the conclusion of these
7 UK sporting bodies that the latest research, evidence
8 and studies now make clear that there are retained
9 differences in strength, stamina and physique in
10 nonbinary --- in transgender women or nonbinary persons
11 registered male at birth with or without testosterone?

12 ATTORNEY BLOCK: Objection to referring
13 to this as something written by the governing bodies as
14 opposed to the quality council that makes
15 recommendations to the governing bodies.

16 THE WITNESS: To the statement written by
17 whoever actually wrote it that evidence and studies on
18 the subject of transgender people make clear anything, I
19 disagree.

20 BY ATTORNEY BROOKS:

21 Q. Let me ask you to turn to page six, under the
22 heading question review is recommending it states,
23 quote, as a result of what the review found the guidance
24 concludes that the inclusion of transgender people into

1 female sport cannot be balanced regarding transgender
2 inclusion, fairness and safety in gender affected sport
3 where there is meaningful competition, period, closed
4 quote.

5 Do you see that?

6 A. I do.

7 Q. And do you disagree with that conclusion of this
8 organization or these organizations?

9 A. So I really --- as we discussed earlier, I'm not
10 going to express as an expert --- I don't think I'd be
11 able to express as an expert fairness and so I can't
12 comment any further.

13 Q. Let me ask you to turn to page nine in your
14 expert report, paragraph 49.

15 A. Okay. Paragraph 49.

16 Q. At the end of paragraph 49 you state, quote, a
17 person's genetic makeup and internal and external
18 reproductive anatomy are not useful indicators of
19 athletic performance and have not been used in elite
20 competition for decades. In making that statement when
21 you refer to a person's genetic makeup were you
22 referring to the question of whether they had XX or XY
23 chromosomes?

24 A. So when I'm making the statement genetic makeup

1 I'm heavily referencing chromosomes. So I guess I would
2 say that is mostly correct with some --- with perhaps
3 some known genes, but mostly chromosomes.

4 Q. You would agree, would you not, that respected
5 voices in the field take the view that genetic sex it is
6 at least an important determinant of athletic
7 performance, do you not?

8 ATTORNEY BLOCK: Objection to form.

9 THE WITNESS: So that I'm supposed to
10 comment that there are people in the field who say that?
11 I guess what I would say is the consensus right now
12 among medical people advising elite athletic
13 organizations would be to move away from using that as a
14 surrogate. In the past it was. There were chromosome
15 tests and the problem is that people have --- there is
16 quite a bit of variety in biology and of course the
17 moment you make a rule you see the exceptions.

18 BY ATTORNEY BROOKS:

19 Q. The exceptions.

20 A. And so I would say that as an expert I can't
21 comment in terms of, you know, some study of everybody's
22 opinion or some survey. But as somebody who has been on
23 these committees I've observed that that was discarded.

24 Q. So if you put alongside individuals who suffer

1 from any condition that has been identified as a
2 disorder of sexual development, am I correct that you
3 consider yourself to have expertise in what constitutes
4 a disorder of sexual development?

5 A. I have some expertise. And the terminology is
6 actually differences of sexual development or sexual
7 differentiation or intersex are the terms that are more
8 popularly used.

9 Q. You would agree with me, would you not, that
10 many respective sources up to the present would continue
11 to refer to disorders of sexual development?

12 ATTORNEY BLOCK: Objection to form.

13 THE WITNESS: So there --- what I would
14 say there is that --- the newer terminology has not ---
15 has not yet permeated because there have not been
16 revisions to all the documents that have been created.

17 BY ATTORNEY BROOKS:

18 Q. How about if we say DSD?

19 A. DSD is a reasonably safe or DSD intersex is what
20 some people do, yes.

21 Q. Well, not all DSDs would be considered intersex
22 conditions.

23 Correct?

24 A. You are right that some people try to parse

1 those two terms even. And there is --- but I think
2 those kinds of distinctions might be on the scope of
3 what we are discussing.

4 Q. Probably so. If we put on side individuals who
5 suffer from anything that is characterized in the field
6 as a DSD you would agree, would you not, that genetic
7 makeup and specifically whether the individual possesses
8 XX or XY chromosomes is a statistically meaningful
9 indicator of athletic performance?

10 ATTORNEY BLOCK: Objection to form.

11 THE WITNESS: So no, and the --- it's ---
12 I guess it depends what you mean is what it comes down
13 to. So if you are --- if you are simply saying, well, a
14 certain fraction of people of these chromosomes are
15 going to be --- have this other characteristic, then
16 maybe there are those kinds of associations. But if you
17 are going to say that it's connected to the point where
18 you could actually use one of those let's say observing
19 a chromosome as an actual determination for a given
20 individual, then I would say no.

21 BY ATTORNEY BROOKS:

22 Q. Is it your opinion that a gender identity itself
23 is a --- or useful indicator of athletic performance?

24 A. It is my opinion that gender identity itself is

1 not a useful indicator of athletic performance.

2 Q. You say at paragraph 44 of your report --- I
3 will save that. I think that is a new Declaration and
4 we will not take time to do that.

5 Let me ask you to look at paragraph 24 of your
6 rebuttal report. You say in paragraph 24 that none of
7 Doctor Carlson's arguments support HB-3293 categorical
8 ban of all girls who are transgender from all girls
9 sports teams.

10 Do you see that?

11 A. I do.

12 Q. And I should continue. I'm sorry. Doctor
13 Carlson's safety argument relates solely to contact and
14 collision sports and the physical characteristics
15 developed during puberty, period. By referring to a
16 categorical ban let me ask this. Do you agree that
17 safety considerations could justify or may justify
18 excluding natal males who experienced all or significant
19 part of male typical pubertal development from
20 participating in female division of contact or collision
21 sports such as basketball and soccer?

22 ATTORNEY BLOCK: Objection to form.

23 THE WITNESS: So if the question is would
24 I anticipate as an expert that there would be a safety

1 explanation for banning transgender women from the
2 female category, then I would --- I wouldn't --- I
3 certainly --- let me think about which way to phrase it.
4 I would have a hard time coming up with an example where
5 I would use being transgender as a safety criterion as
6 opposed to body habitus size or some other more
7 objective criterion.

8 BY ATTORNEY BROOKS:

9 Q. Well, and I didn't say anything about gender
10 status. Let me ask again. Would you agree that safety
11 considerations could justify excluding natal males who
12 have experienced all or a significant part of male
13 typical pubertal development from participating in
14 female division contact and collision sports such as
15 basketball or soccer?

16 ATTORNEY BLOCK: Objection to form.

17 THE WITNESS: So you're saying that even
18 if we otherwise decided that it would be okay for
19 cisgender males to play with cisgender females, would I
20 envision there being a safety reason to ban those
21 cisgender males?

22 BY ATTORNEY BROOKS:

23 Q. All I asked had nothing to do with gender
24 identity. Do you agree that the introduction onto the

1 field or the court in or have been spoken of its contact
2 or collision sports in the female division of natal
3 males who have gone through all or a significant part of
4 male typical pubertal development could raise legitimate
5 concerns about safety for the natal females?

6 ATTORNEY BLOCK: Same objections as the
7 previous two questions.

8 THE WITNESS: So any person who's gone
9 through a male puberty would that, per se, make me
10 invoke a safety concern, if that's the question ---.

11 BY ATTORNEY BROOKS:

12 Q. Could that in your mind raise the given safety
13 concerns?

14 A. So I would not --- the word legitimate I'm not
15 addressing, but I'm not aware of that in and of itself
16 being a safety concern.

17 Q. You state in paragraph 22 of your rebuttal
18 report that, quote, transgender athletes and women have
19 been competing in NCAA and secondary school athletics
20 for many years at this point. Let me ask you if you are
21 aware of any instance in which natal males have competed
22 in the female category in any contact or collision sport
23 in either the NCAA or high school division?

24 ATTORNEY BLOCK: Objection to form.

1 THE WITNESS: So can I identify
2 transgender girls or women specifically and specific
3 instances of participation? I cannot.

4 BY ATTORNEY BROOKS:

5 Q. What was your basis for asserting that such
6 athletes have been competing in the NCAA and secondary
7 school athletics for many years?

8 ATTORNEY BLOCK: I'm sorry. Is the
9 question about collision sports? Because you are
10 quoting something that is not about collision sports.

11 ATTORNEY BROOKS: Let me break that out.
12 Thank you.

13 BY ATTORNEY BROOKS:

14 Q. Do you have a view as to whether --- I shouldn't
15 say a view. Do you have any information as to whether
16 transgender athletes have been competing in the women's
17 division of NCAA or secondary school athletics in any
18 contact or collision sports for many years?

19 A. That information on the validity is that they
20 have had access because there has not been a ban.

21 Q. But whether they have done so you do not have
22 any information?

23 A. But I cannot point to specific instances,
24 exactly.

1 Q. I apologize if I asked something early in the
2 morning, but it's faster than trying to dig back into
3 the transcript. Do you have any opinion as to whether
4 it is reasonable to exclude a natal male with a male
5 gender identity from a high school girls basketball
6 team?

7 ATTORNEY BLOCK: Objection to form.

8 THE WITNESS: So ask that again a little
9 bit slower.

10 BY ATTORNEY BROOKS:

11 Q. Do you have have any opinion as to whether it is
12 reasonable to exclude a natal male with a male gender
13 identity from participation in a girls high school
14 basketball team?

15 ATTORNEY BLOCK: Objection.

16 THE WITNESS: I do not have an expert
17 opinion on that subject.

18 BY ATTORNEY BROOKS:

19 Q. Do you have a personal view?

20 A. I don't know that I --- there it would get more
21 complicated depending on context.

22 Q. You don't have a simple yes or no personal view
23 on that question?

24 A. I don't.

1 Q. And do you have a view whether it is reasonable
2 to exclude a natal male with a female gender identity
3 from participation in a high school girls basketball
4 team?

5 ATTORNEY BLOCK: Objection to form.

6 THE WITNESS: So do I have a view on
7 participation of a cisgender girl in the girls category?
8 Sorry. Say it again.

9 BY ATTORNEY BROOKS:

10 Q. I said do you have a view on whether it is
11 reasonable to exclude a natal male with a female gender
12 identity from participation in the high school girls
13 basketball team?

14 ATTORNEY BLOCK: Objection to form.

15 THE WITNESS: So that is a transgender
16 girl, got it. So --- and the question is do I have a
17 view on --- I apologize. Go back.

18 BY ATTORNEY BROOKS:

19 Q. I can do it again.

20 A. Yes, do it again. Sorry.

21 Q. Do you have a view as to whether it is
22 reasonable to exclude a natal male with a transgender
23 identity from participation in the girls high school
24 basketball team?

1 ATTORNEY BLOCK: Objection to form.

2 THE WITNESS: And it is do I have a view
3 on excluding --- as an expert am I opining on that? I'm
4 not. I'm opining as a scientist on what the data are.

5 BY ATTORNEY BROOKS:

6 Q. Do you consider a policy that excludes natal
7 males with a male gender identity from the girls
8 basketball team to be, quote, discriminatory?

9 ATTORNEY BLOCK: Objection to form and
10 scope.

11 THE WITNESS: So as an expert I'm not
12 taking a position on excluding cisgender males from the
13 female category, if I answered that correctly.

14 BY ATTORNEY BROOKS:

15 Q. My question was simply do you consider such a
16 policy to be a discriminatory policy?

17 ATTORNEY BLOCK: Objection to form and
18 scope.

19 THE WITNESS: So are you asking me as an
20 expert to define discrimination?

21 BY ATTORNEY BROOKS:

22 Q. I will direct you to paragraph 27 of your
23 rebuttal report. And there you wrote Doctor Carlson has
24 not offered cogent explanation for why alleged safety

1 concerns based on average differences in size and
2 strength should be addressed within an across the board
3 exclusion of transgender women as opposed to tailored
4 nondiscriminatory policies.

5 Do you see that?

6 A. I do.

7 Q. So understanding discriminatory, however you did
8 understand it when you wrote that, do you consider a
9 policy that prohibits natal males with a male gender
10 identity from participating on the girls basketball team
11 to be a discriminatory policy?

12 ATTORNEY BLOCK: Same objections.

13 THE WITNESS: Right. So I'm not defining
14 --- I'm not defining discriminatory here. I'm ---
15 right. So if you are asking as an expert to define
16 discriminatory, that I can't do.

17 BY ATTORNEY BROOKS:

18 Q. Well, if you don't know what discriminatory
19 means, what do you mean when you referred to a tailored
20 nondiscriminatory policy?

21 ATTORNEY BLOCK: Objection to form.

22 THE WITNESS: I guess I have to circle
23 back initially to --- I mean we can do that for any word
24 here, right, where I could have like my own personal

1 definition or am I acting as an expert to define these
2 words, and I think we are kind of in that situation.

3 BY ATTORNEY BROOKS:

4 Q. But I'm asking you about your expert reports in
5 the litigation. You must have meant something. What
6 did you mean by nondiscriminatory when you submitted
7 this expert report?

8 ATTORNEY BLOCK: Objection to form.

9 THE WITNESS: So when I'm using the word
10 nondiscriminatory I am using it to mean something that
11 isn't using some other indicator --- well, I'm really
12 just using it in the broadest sense to something that is
13 including people.

14 BY ATTORNEY BROOKS:

15 Q. Using it in the broadest sense, discriminating
16 between one category and another is --- could be a good
17 thing or a bad thing.

18 Correct?

19 ATTORNEY BLOCK: Objection to form.

20 THE WITNESS: As an expert I --- that is
21 way outside my scope. But simply as an English speaker,
22 yes, discrimination could be good or it can be bad, yes.

23 BY ATTORNEY BROOKS:

24 Q. And for instance, if you are --- well, you said

1 you don't prescribe to minors, so --- but if you are
2 dealing with a 19-year-old who says and you concluded I
3 need gender affirming hormone, and I will use the term
4 you prefer, if that individual's hormones and biology
5 are female then gender affirming hormones are going to
6 consist, among other things, perhaps of administering
7 testosterone.

8 Correct?

9 A. Yes, typically we would have have ---.

10 Q. And if that individual's biology and hormones
11 endogenous were male, then the gender affirming hormones
12 would include among other things estrogen or estrogen
13 analog.

14 Correct?

15 ATTORNEY BLOCK: Objection to form.

16 THE WITNESS: If that person had
17 typically --- typically a male hormone profile, right,
18 to move toward a more feminine profile that typically
19 would include estrogens or some other agents that were
20 other than testosterone, yes.

21 BY ATTORNEY BROOKS:

22 Q. So speaking scientifically and not in civil
23 rights terms, if I may, you as a scientist, as you
24 decide which regimen of hormones to administer to this

1 individual have to discriminate between those who are
2 endogenously male and those who are endogenously female
3 in deciding which regimen you prescribe.

4 Correct?

5 ATTORNEY BLOCK: Objection to the form.

6 THE WITNESS: We have to make a decision.

7 And so if you are trying to get me to say that
8 discrimination can be defined as making decisions, I'm
9 with you and yes.

10 BY ATTORNEY BROOKS:

11 Q. Okay.

12 Let me just run down a few items to make sure.
13 You have not personally engaged in any research
14 regarding sports physiology, have you?

15 A. I'm trying to think if there's anything. I
16 don't believe I have.

17 Q. You yourself haven't personally engaged in any
18 research or published any papers --- that's a compound
19 question. You, yourself, haven't engaged in any
20 research relating to sports medicine or sports injuries,
21 have you?

22 A. I have not engaged in any research with regard
23 to sports injuries. And the answer to the first part of
24 that gets a little muddled because some of the papers

1 that I have written about physiology and transgender
2 people could apply to sports medicine.

3 Q. Have you, yourself, ever participated in
4 devising any athletic training regimes for individuals
5 of either sex?

6 A. I've not been involved in devising any training
7 regimes.

8 Q. Have you done any research with related to male
9 physiology --- I'm sorry, male physiological advantages
10 relevant to athletics before, during or after puberty?

11 A. So there I have --- none of the research that I
12 have done to date has been specifically loopholed as ---
13 well, I can't even say that. So research that I have
14 done with regard to observing physiology among my
15 subjects can be applicable to sports medicine in some
16 context.

17 Q. On what publications, if any, of yours do you
18 believe relate to male physiological advantages in
19 athletics before, during or after puberty?

20 A. Well, just off the top of my head, without
21 looking at it exhaustively, I have a paper on
22 hematocrit, which is the oxygen-carrying cells in
23 people. In transgender people I have a paper on
24 testosterone levels with different treatments. So those

1 can have --- those actually can have a sports context.

2 Q. Have you done any research on the impact of
3 testosterone suppression on athletic performance or any
4 measurement of strength?

5 A. So the second piece of that is I have not done
6 any research that specifically used strength as an
7 endpoint in my own studies. To the second piece of
8 those --- I forgot what ---.

9 Q. Athletic performance?

10 A. Athletic performance, there it gets a muddled
11 thing. The research that I have done can be applicable
12 in that context.

13 Q. Well, that is if your endpoint is hematocrit
14 count, to use the right term, you're saying that might
15 have implications for athletic performance? Is that
16 your point?

17 A. That is correct, yes.

18 Q. But you have not done any research in which any
19 measurement of athletic performance is an endpoint?

20 ATTORNEY BLOCK: Objection to form.

21 THE WITNESS: Again, I have to think
22 about how to say that because some of the --- part of
23 the problem is that papers that we're looking at include
24 quite a bit of literature on components that may be

1 applicable --- that may be applicable in sports
2 medicine, whether it is muscle strength and muscle size
3 or blood cell counts and such. And so that more
4 expansively than my research is in that category.
5 Whereas, if I'm trying to be focused and narrow, then
6 I've got those two studies, the one by Roberts and the
7 one by Harper. And my papers are not those.

8 BY ATTORNEY BROOKS:

9 Q. You don't have any information about numbers of
10 children in West Virginia who suffer from any DSD, do
11 you?

12 A. No, as --- I guess I have to say no there in
13 terms of actual surveys of kids in West Virginia, I know
14 some brought statistics. West Virginia is big enough
15 that you would predict that the statistics would
16 generally apply, but that is as smart as I could get on
17 the subject.

18 Q. And you are --- I think you effectively answered
19 this, but to be clear for the record you are not opining
20 that BPJ suffers from any DSD?

21 ATTORNEY BLOCK: Objection to the form.

22 THE WITNESS: So the --- here too we get
23 into --- into an evolving area of definitions where you
24 could envision if some of the specific genetics that are

1 associated with being transgender became identified,
2 would we in the medical world start to label those
3 instances as DSD? It's possible. So that is just ---.

4 BY ATTORNEY BROOKS:

5 Q. Thus far no such indicators have been
6 identified.

7 Correct?

8 A. I can't even --- I can't even say that
9 definitively. It is an area of active conversation in
10 terms of --- in terms of boarder setting in the medical
11 community right now.

12 Q. However, I think my question is easier. You're
13 not offering an opinion --- any opinion that BPJ suffers
14 from any DSD, are you?

15 A. So I don't have --- so to be clear first I don't
16 know the --- BPJ's specific medical condition. I wasn't
17 brought in to evaluate that and I have not. So I can't
18 actually render an opinion on any of the medical story
19 there.

20 Q. And you don't know whether any child or typical
21 XY chromosome --- pardon me, you don't know whether any
22 child with XY chromosomes who suffers from a DSD has
23 ever sought to compete in female athletics in West
24 Virginia up until the present?

1 ATTORNEY BLOCK: Objection to the form.

2 THE WITNESS: So the question is do I
3 know of an instance of a specific individual with XY
4 chromosomes and a DSD connected to that who has
5 specifically participated in sports in West Virginia?

6 BY ATTORNEY BROOKS:

7 Q. Who has sought to participate in female
8 athletics in West Virginia?

9 A. Right, so who has sought to participate in
10 female sports in West Virginia. I cannot give you a
11 specific instance, that is true. I can say, though,
12 knowing the percentage of people who have DSDs and the
13 size of the State of West Virginia that you would
14 predict it would be true, but that would be again as
15 smart as I could be on one subject.

16 ATTORNEY BROOKS: Let me mark as Safer
17 Exhibit 15 what was previously designated as Tab 53, an
18 article by Dr. Safer and others entitled the Mount Sinai
19 Patient Center Preoperative Criteria Meant to Optimize
20 Outcomes are Less of a Barrier to Care than WPATH SOC 7
21 Criteria Before Transgender Specific Surgery. And yes,
22 that is a mouthful.

23 ---

24 (Whereupon, Exhibit 15, Dr. Safer Article,

1 was marked for identification.)

2 ---

3 BY ATTORNEY BROOKS:

4 Q. Now, Dr. Safer, to be fair, I see that you are
5 the last listed author on a fairly lengthy list of
6 authors. And maybe that does and maybe that doesn't
7 have significance in terms of how in depth your
8 involvement in this paper was. Let me ask. Was this a
9 paper of which you had some significant input?

10 A. I had significant input. I can tell you that in
11 the medical and scientific community the first author
12 typically did the work and the last author is the senior
13 author and supervisor. And the middle authors are
14 actually the ones where you ---.

15 Q. Okay.

16 I was aware of the significance of the first.
17 I was not aware of the significance of the last. Okay.
18 That is helpful. All of the authors here, if I'm
19 correct, are colleagues within the Mount Sinai Clinic or
20 division that you supervise.

21 Am I correct?

22 A. All of the authors were in those positions at
23 some point, which is how we came together to write the
24 paper.

1 Q. And the paper I should say for the record is
2 dated 2020. And let me see if I correctly understood
3 what the paper is about. If we --- in this paper you
4 compare the eligibility of patients who are seeking
5 vaginoplasty under the WPATH Standard of Care 7 criteria
6 versus the criteria actually used by your clinic.

7 Am I correct?

8 A. Yes.

9 Q. And just so we're clear, vaginoplasty is a
10 surgery that is only done on biological male, natal male
11 individuals.

12 Correct?

13 ATTORNEY BLOCK: Objection to form.

14 THE WITNESS: So a vaginal plasty is the
15 genital reconstruction surgery to create a vagina in a
16 person. When we are using it as a gender affirming
17 surgery, then we are using it on people who have what
18 would be considered typically male anatomy in that
19 circumstance but the surgery could also be used on
20 somebody with typically female anatomy requiring
21 construction for whatever their circumstance may be.

22 BY ATTORNEY BROOKS:

23 Q. That said, the subjects discussed in this paper
24 are all individuals who are seeking the surgery for

1 gender affirming purposes rather than, for instance,
2 because of a severe DSD.

3 Correct?

4 A. The people in this circumstance are all people
5 seeking the surgery for gender affirming purposes and
6 not those for DSD or for other purposes, reconstruction
7 of vaginas for accidents and cancers. I mean there is
8 quite a range.

9 Q. And the result as summarized in the abstract is
10 that of 139 patients who were identified as subjects of
11 this study, 63 qualified for surgery immediately based
12 on the Mount Sinai criteria.

13 Correct?

14 A. Yes.

15 Q. Whereas only 21 of those would have qualified
16 based on the criteria set out in the WPATH Standard of
17 Care Version 7?

18 A. Yes.

19 Q. Three times as many individuals qualified for
20 immediate surgery under the standard used by your clinic
21 as opposed to the standards set out in the WPATH
22 Standard of Care?

23 A. That's correct.

24 Q. When did your clinic begin approving surgery for

1 patients who are not eligible under the WPATH Standard
2 of Care?

3 ATTORNEY BLOCK: Objection to form.

4 THE WITNESS: Yeah, so to be clear, the
5 patients in our program qualify by both criteria. The
6 paper is simply pointing out that our process is more
7 efficient and patient friendly, but it's not to say that
8 we were not informed by WPATH criteria also. And I
9 think I need to expand even a little bit further. Part
10 of the point of the paper is that it includes --- it
11 includes efforts to know benefit to the patient that end
12 up being time consuming and therefore are a waste of
13 energy in contrast to our approach, which is actually
14 more conservative than WPATH's approach. We actually
15 look at more things but we do so in a more efficient
16 fashion and that is actually the point of the paper.

17 BY ATTORNEY BROOKS:

18 Q. Well, let me clarify one thing you just said.
19 According to this paper, it is not the case, is it, that
20 every patient for whom your clinic approved surgery was
21 at that time qualified according to the WPATH criteria?

22 ATTORNEY BLOCK: Objection to form.

23 THE WITNESS: Wait. Say it again. Could
24 you repeat that?

1 BY ATTORNEY BROOKS:

2 Q. It is not the case, is it, that every patient
3 who was qualified for surgery by your clinic had been
4 demonstrated to satisfy the WPATH criteria for
5 eligibility?

6 A. It is --- so there were --- the patients just as
7 stated who qualified by our criteria but not by WPATH
8 criteria, there is such a group that existed, exactly,
9 yes.

10 Q. Okay.

11 And specifically, according to your criteria,
12 three times as many patients are eligible according to
13 WPATH criteria?

14 ATTORNEY BLOCK: Objection to form.

15 THE WITNESS: It's not so much the three
16 times. It is the pace. Some of this relates to pace
17 and efficiency.

18 BY ATTORNEY BROOKS:

19 Q. Dr. Safer, your clinic, according to this paper,
20 approved for surgery 42 patients who were at that time
21 not eligible according to WPATH criteria.

22 Correct?

23 ATTORNEY BLOCK: Objection to form.

24 THE WITNESS: No. So the reality is we

1 still live in the universe that everybody else lives in,
2 so we are --- so this paper proposes a more appropriate
3 and a more patient appropriate model, but it is not the
4 case that we actually sent people to surgery who would
5 not be approved by WPATH.

6 BY ATTORNEY BROOKS:

7 Q. Well, were you personally involved in developing
8 and approving Mount Sinai's criteria?

9 A. Let me look at the role here. Yes, I definitely
10 had a role in developing our criteria.

11 Q. Let me ask you to look at page 168, column one,
12 call your attention quite a bit to table one. And if I
13 understand correctly, table one is designed to help us
14 compare and contrast what is required by the WPATH
15 criteria for surgical readiness versus the Mount Sinai
16 criteria for surgical readiness.

17 Correct?

18 A. That is correct, yes.

19 Q. And the WPATH requires a letter of support from
20 the patient's hormone provider confirming the hormone
21 regimen and the length of time of hormone therapy.

22 Correct?

23 A. That is how it is written, yes.

24 Q. And farther down, under mental health it says

1 that it requires two letters of support from mental
2 health providers?

3 A. It does, yes.

4 Q. And it gives on page 157 a definition who is a
5 qualified mental health professional down towards the
6 bottom of the second column. I'm going to ask you to
7 find that language if you could?

8 A. Uh-huh (yes), yes.

9 Q. You say, many define licensed mental health
10 providers having one or more of the following
11 credentials, the LCSW, Licensed Clinical Social Worker.

12 Is that right?

13 A. LCSW is Licensed Clinical Social Worker, yes.

14 Q. And MD, DO that is a medical doctor, a doctor of
15 --- what does the O stand for?

16 A. Osteopathy.

17 Q. There we go. A psychiatrist, a Ph.D., yes, that
18 was surprising to me. Surely not just any Ph.D.?

19 A. Right, that's referring to a Ph.D. clinical
20 psychologist.

21 Q. Okay.

22 Or any Master's level for above counseling
23 degrees. But then you go on to say that in your
24 evaluation based on SOC-7 criteria. That's the WPATH

1 criteria?

2 A. That's the WPATH criteria, yes.

3 Q. We included the above degrees with the following
4 exclusions, mental health providers with lower than
5 Master's level training and unlicensed mental health
6 providers of any type, NPs and PAs without mental health
7 credentials, physicians who are not psychiatrists or
8 mental health providers who are still in training. Do
9 you see that language?

10 A. I do.

11 Q. So under the definition used in your clinic you,
12 yourself, do not qualify as a mental health
13 professional.

14 Correct?

15 A. That is correct.

16 Q. So at no point have you relied on your own
17 opinion for any mental health evaluation for
18 eligibility?

19 A. That's correct.

20 Q. Okay.

21 I just wanted to understand that clearly. So
22 back to mental health data. It says in the WPATH column
23 that two letters of support from mental health providers
24 are required. In this paper you state on the next page,

1 but I will quote it the most significant of the Mount
2 Sinai criteria is the removal of the requirement of two
3 independent psychiatric evaluations. And that is in
4 column two of page 169, at the end of the first full
5 paragraph. The first full paragraph, column two, the
6 final sentence.

7 A. I'm in which column? Sorry.

8 Q. Column two.

9 A. Oh, column two. Sorry.

10 Q. The first full paragraph, final sentence.

11 A. The most significant deletion from the Mount
12 Sinai criteria is the removal of --- yes, I see that.

13 Q. And you stated at the top of column one on the
14 same page that, quote, finding two mental health
15 providers to do independent evaluations is
16 time-consuming, expensive and difficult.

17 Right?

18 A. Just trying to find that exact wording. Yes.

19 Q. So in your own clinic's practice, while WPATH
20 calls for two letters from independent mental health
21 providers, you concluded that because it was hard to get
22 two independent evaluations your clinic would simply
23 dispense with the requirement of any independent mental
24 health review.

1 Correct?

2 ATTORNEY BLOCK: Objection to form.

3 THE WITNESS: No, that is not quite
4 correct. Part of the difference for our operation is
5 that we have --- we have expertise in-house and we have
6 --- if you notice, looking at the table, a longer list
7 of requirements actually than WPATH does, which includes
8 a social work component. And that actually is the ---
9 that's the source of actually yet a second pair of eyes,
10 as it were. And so it is not the case that we are ---
11 that we're providing less of a screen, we are actually
12 providing more of a screen. It's just that we are
13 operating in a more efficient manner for the patient.

14 BY ATTORNEY BROOKS:

15 Q. Let's flip back to column one. A few more lines
16 down it says for our analysis patients who otherwise met
17 WPATH SOC 7 criteria received one letter of support from
18 the CTMS mental health provider. Right? You would
19 agree with me, would you not, that the only letter of
20 support for a mental health provider required by your
21 protocols is from a mental health provider within your
22 employment?

23 ATTORNEY BLOCK: Objection to not reading
24 the complete sentence.

1 THE WITNESS: So yes. So maybe let me
2 just --- show me the wording again.

3 BY ATTORNEY BROOKS:

4 Q. Yes. For our analysis --- and I'm beginning at
5 perhaps eight lines down.

6 A. Our analysis, yes.

7 Q. Patients who otherwise met WPATH SOC 7 criteria
8 received one letter of support from the CTMS mental
9 health provider doing the assessment, period, closed
10 quoted.

11 Do you see that?

12 A. I do, yes.

13 Q. As the term is generally understood in your
14 field, a CTMS mental health provider is not independent
15 --- let me use the correct terminology, is not an
16 independent mental health provider?

17 A. So in a clinic setting I don't know that the
18 word independent actually has the same meaning as in
19 some other context. So even a WPATH requirement isn't
20 necessarily that it would be an unaffiliated person or I
21 don't know what you were thinking independent might mean
22 here, so I don't want to put words in your mouth or
23 conjecture too much. But when we say independent we
24 just mean two different people.

1 Q. But in fact, the letter of support from the CTMS
2 mental health provider that you refer to in this
3 paragraph at the top of column one of page 169 actually
4 plays no role in your determination as to whether this
5 patient is eligible for surgery.

6 Correct?

7 ATTORNEY BLOCK: Objection to form.

8 THE WITNESS: So yes. I'm confused by
9 the question.

10 BY ATTORNEY BROOKS:

11 Q. I'm confused by the text. The final paragraph
12 --- sentence in that paragraph reads these letters of
13 support were used to satisfy third payor requirements to
14 cover surgery and were not part of the CTMS assessment?

15 A. Oh, yeah, that's a good point. The literal
16 letter is because we are all in-house the opinion of the
17 person is, of course, important and so the screen takes
18 place. But the need to create --- the bureaucratic of
19 creating a specific letter is one of the burdens that we
20 are suggesting could be removed.

21 Q. In table one, let me find this. Under mental
22 health WPATH SOC-7 requires, quote, persistent, well
23 documented gender dysphoria.

24 Do you see that?

1 A. I do.

2 Q. And you understand well documented gender
3 dysphoria to be referring to a general diagnosis under
4 the DSM-V criteria?

5 A. So for WPATH's purposes I think they are
6 specifically referring to the DSM diagnosis.

7 Q. In your clinic you are willing to approve for
8 this --- I'm not sure how to actually say the word
9 vaginoplasty surgery, individuals who do not suffer from
10 persistent well documented gender dysphoria.

11 Correct?

12 ATTORNEY BLOCK: Objection to the form.

13 THE WITNESS: So if you look, the list of
14 the criteria for Mount Sinai, then the phrasing is a
15 confirmation that this person --- for all intents and
16 purposes, that this person is transgender and with the
17 language and evolution we use that word gender dysphoria
18 and we also use the new word that will replace gender
19 dysphoria, gender incongruence, as the terms I
20 referenced before, transgender.

21 BY ATTORNEY BROOKS:

22 Q. And the effect of that is you do not require a
23 diagnosis of gender dysphoria under the terms of DSM-V.

24 Correct?

1 ATTORNEY BLOCK: Objection to form.

2 THE WITNESS: So the --- yeah, if we had
3 our druthers, which is I think you are asking, and we
4 did not --- and we weren't simply satisfying a third
5 party payor, would we insist on that formal DSM-V
6 criteria for a person we otherwise know to be
7 transgender? We would not.

8 BY ATTORNEY BROOKS:

9 Q. And in fact, you do not.
10 Correct?

11 ATTORNEY BLOCK: Objection to form.

12 THE WITNESS: Well, as a practical
13 matter, like I said, we live in a universe where we end
14 up doing both what we suggest is the necessary approach
15 and we end up, because we still live in the universe
16 that we live in, satisfying the other approach even
17 though we're suggesting that it's cumbersome.

18 BY ATTORNEY BROOKS:

19 Q. Dr. Safer, you testified earlier that, in fact,
20 in 42 patients your clinic determined they were surgery
21 eligible even though they did not satisfy the SOC
22 criteria listed in column one of table one?

23 A. Right. So they are not --- so they would be ---
24 they theoretically would be eligible without having

1 satisfied the --- some of those specific WPATH criteria
2 that we discussed. But in practice nobody went to
3 surgery without covering both sets of criteria.

4 Q. Isn't the precise results reported by this paper
5 that 42 patients were deemed surgery approved who did
6 not qualify under WPATH criteria?

7 A. But I guess the bottom line of the paper is that
8 if we followed our --- our rules alone, we would
9 actually cover more details and be more conservative in
10 our approach if a longer list of criteria and we would
11 do so more quickly. That's all the paper says. It
12 doesn't say that we have --- that we have actively
13 defied the existing universe and sent people to surgery
14 without covering the criteria that are generally being
15 used by doctors.

16 Q. And by the way, the surgery we're talking about,
17 vaginoplasty, in the context where it is being used for
18 gender affirming purposes, invariably includes
19 castrating the individual.

20 Correct?

21 ATTORNEY BLOCK: Objection to form and
22 foundation.

23 THE WITNESS: So a vaginoplasty is a
24 genital reconstruction surgery, which in this context is

1 taking the existing typically --- typical male genitalia
2 and reconfiguring it into typically female genitalia.
3 And in that --- in the procedure the testes are removed.

4 BY ATTORNEY BROOKS:

5 Q. They're not reconfigured?

6 A. They are not reconfigured.

7 Q. Let me ask you 169, column one, it says about
8 two-thirds of the way down, at the end of the paragraph
9 that begins medical requirements for the Mount Sinai
10 CTMS? I want to direct your opinion --- your attention
11 to the final sentence.

12 A. So which paragraph, column one.

13 Q. Column one, the paragraph that begins halfway
14 down, medical requirements?

15 A. Yes.

16 Q. Now, let's jump to the end. The Mount Sinai
17 criteria also removed the 12-month continuous hormone
18 therapy requirement for the vaginoplasty which
19 complicates matters for people who have received hormone
20 therapy from non-medical providers.

21 Do you see that language?

22 A. I do.

23 Q. Explain to me the reference for people who have
24 received hormone therapy from non-medical providers?

1 A. Well, it is the circumstance that some people
2 more so outside of New York, some transgender people
3 still do not have access to care for --- to gender
4 affirming care and do get some of their treatment by
5 alternative means. And if there is an insistence on a
6 documented 12-month continuous hormone therapy
7 requirement, then those people might not be able to be
8 approved for surgery.

9 Q. I need to ask you to clarify what you mean by
10 obtaining by alternate means?

11 A. We have people getting hormones from internet
12 providers. We have people inappropriate --- well, I
13 apologize, I don't want to make a value judgment there,
14 but we have people getting hormones from friends or
15 connections of theirs, things outside the system.

16 Q. So you have some people come to you who have
17 effectively self-diagnosed and self-prescribed ---

18 ATTORNEY BLOCK: Objection.

19 BY ATTORNEY BROOKS:

20 Q. --- hormone therapies?

21 ATTORNEY BLOCK: Objection to form.

22 THE WITNESS: So when we are seeing
23 people for surgeries, then it is no longer a matter of
24 self-diagnosis because we see them ourselves with our

1 internal team. But there are people who have
2 self-prescribed their hormones or obtained them by
3 nonconventional means, that part, yes.

4 BY ATTORNEY BROOKS:

5 Q. And when people come in who have obtained
6 hormones by nonconventional means and taken them without
7 prescription necessarily, you chose to remove the
8 requirement for 12 months properly prescribed continuous
9 hormone therapy rather than insisting that the patients
10 undergo control of hormone therapy for 12 months before
11 you operate on them?

12 ATTORNEY BLOCK: Objection to form.

13 THE WITNESS: So to clarify, again, these
14 are --- we are proposing that this would be the
15 protocol. In practice, we have not been able to do
16 this, that is we have had to do both. But in our
17 experience, as a program we don't see any benefit to a
18 supervised --- a supervised regimen, that is we are not
19 --- I'll just leave it there.

20 BY ATTORNEY BROOKS:

21 Q. WPATH in table one requires that all psychiatric
22 symptoms be, quote, well controlled.

23 Correct?

24 A. They use that language, yes.

1 Q. And the language under the CTMS column is rather
2 different. Among other things it says no suicide
3 attempt in the last six months. Do you see that?

4 A. Let me find it. We're in the table, right?

5 Q. We are in the mental health section under CTMS
6 column?

7 A. Yes.

8 Q. No suicide attempt in the last six months. But
9 if the patient tried to commit suicide seven months ago,
10 that's okay?

11 ATTORNEY BLOCK: Objection to form.

12 THE WITNESS: So the point here and the
13 distinction is that the WPATH criteria are too vague,
14 and so what you are observing with the Mount Sinai
15 criteria is they're much more granular. And rather than
16 leaving something to some subjective interpretation we
17 define some of the specifics to make it clearer on what
18 the guidelines should be.

19 BY ATTORNEY BROOKS:

20 Q. You refer here in your guideline to no suicide
21 attempt in the last six months. If a patient has
22 entertained suicidal thoughts but made no attempt in the
23 last six months, did that patient potentially satisfy
24 the Mount Sinai criteria?

1 A. So that kind of decision would be at the
2 discretion of the reviewing mental health professional,
3 the psychiatrist or the psychologist, and so you can
4 certainly envision different circumstances. So even
5 going back to your example of seven months, you could
6 envision that something like that might be considered,
7 depending upon the person, too unstable even though they
8 technically met criteria. This isn't just a check box.
9 It is more a guideline. And similarly, to your point
10 about a suicidal ideation, there are different tiers of
11 them. And I won't claim to be an expert on the
12 specifics there, but my mental health professionals are
13 more concerned about some of those than others.

14 ATTORNEY BROOKS: Take a break.

15 VIDEOGRAPHER: The current time reads
16 3:35 p.m. Eastern Standard Time.

17 OFF VIDEOTAPE

18 - - -

19 (WHEREUPON, A SHORT BREAK WAS TAKEN.)

20 - - -

21 ON VIDEOTAPE

22 VIDEOGRAPHER: We are back on the record.
23 The current time is 3:55 p.m. Eastern Standard Time.

24 BY ATTORNEY BROOKS:

1 Q. Dr. Safer, you testified earlier, and I think
2 I'm using the word that you used that if your clinic had
3 its druthers they would be following or making decisions
4 strictly based on the criteria that are laid out in this
5 paper, Exhibit 15, under the heading of Mount Sinai
6 CTMS.

7 Correct?

8 A. Yes.

9 Q. And can I infer from that that you, yourself,
10 don't view the WPATH SOC-7 as setting out scientifically
11 established best practices but rather recommendations on
12 which you use different?

13 ATTORNEY BLOCK: Objection to form.

14 THE WITNESS: No, I would not say that.
15 So SOC-7 sets out the guidelines as things were
16 understood in 2011 and 2012, and we have learned ---
17 we've learned and things have evolved since then in
18 terms of the care of transgender people.

19 BY ATTORNEY BROOKS:

20 Q. Did you have any participation in the
21 development of the SOC-7 guidelines?

22 A. I had very minimal participation. I helped
23 review some articles that informed those guidelines.

24 Q. Those guidelines --- did you have any

1 familiarity with the process of how they were being
2 drafted?

3 A. I'm trying to think if I can say things
4 usefully. I was not close enough to the process that we
5 would want --- that I would want to start commenting on.

6 Q. Do you know whether they addressed issues on
7 which opinions within the drafting committee differed?

8 A. I can't comment on SOC-7. We are literally
9 writing SOC-8 now.

10 Q. And on that are there issues that the SOC-8 is
11 addressing on which opinions significantly differ?

12 A. Yes.

13 Q. So it's not that every aspect of the guidelines
14 are unanimously agreed by every member?

15 ATTORNEY BLOCK: Objection to form.

16 THE WITNESS: So with medical guidelines
17 in general there isn't --- that unanimity wouldn't be a
18 thing. They're referred to as consensus documents
19 rather than unanimous documents.

20 BY ATTORNEY BROOKS:

21 Q. And what that tells us is that there is --- that
22 reasonable people differ on at least some aspects of
23 what is set forth in the document?

24 ATTORNEY BLOCK: Objection to form.

1 THE WITNESS: In all guidelines,
2 including these, members of the committee even differ in
3 terms of how things are framed and when consensus is
4 obtained, but not unanimity.

5 BY ATTORNEY BROOKS:

6 Q. How many gender performing surgeries or gender
7 affirming surgeries were performed in your clinic in
8 2021?

9 A. In 2021, all --- there were, according to the
10 New York Times, about 9,000 total surgeries performed at
11 Mount Sinai hospitals, including everything we do. So
12 that wouldn't just be vaginoplasty. That would include
13 chest reconstruction surgeries, revisions of older
14 surgeries, et cetera.

15 Q. Well, you quote the New York Times. Where did
16 they get the information?

17 A. I suppose the sources is us.

18 Q. You believe that number to be approximately
19 accurate?

20 A. I think that's right.

21 Q. I don't trust the New York Times, but you have a
22 pass. And now 2021 may or may not have been affected by
23 COVID in terms of patients presenting and wanting
24 surgery. Has there been a clear trend in numbers of

1 surgeries performed by your clinic over the last five
2 years?

3 ATTORNEY BLOCK: Objection to form.

4 THE WITNESS: So there is definitely an
5 increase in the number of surgeries at Mount Sinai over
6 the past five years. Unfortunately, expectation is the
7 challenge. We opened the program in 2016, so roughly
8 those five years. And certainly the first few years
9 were quieter as the reputation grew. In 2020, numbers
10 were down because we had to divert resources to taking
11 care of people with COVID. Our group, including myself,
12 literally dropped what we were doing for a period of
13 time to go become COVID hospital employees, and so there
14 was a dip there in 2021 as a little bit of a rebound
15 element to it.

16 BY ATTORNEY BROOKS:

17 Q. Are you able to give me any average total
18 receipts of your clinic or the hospital as a whole and
19 associated physicians from gender affirming surgeries
20 performed within 2021?

21 A. I'm sorry, say that again.

22 Q. Let me just ask this again. Do you have any
23 knowledge as the total --- as to the total receipts of
24 your clinic or the wider hospital and physicians

1 involved as a result of gender affirming surgeries
2 performed by your clinic in the last year?

3 A. So do I know some of the financial elements?

4 Q. Correct.

5 A. So I do know some of the financial elements, but
6 nothing that the hospital would allow me to share.

7 Q. Your counsel can designate it as confidential
8 later on, so it doesn't become public, but you are
9 obliged to answer the question.

10 ATTORNEY BLOCK: I'm not ---.

11 BY ATTORNEY BROOKS:

12 Q. I'm entitled to understand your financial
13 interest in the area of your testimony.

14 ATTORNEY BLOCK: We are not representing
15 him in the context of any legal dispute with Mount
16 Sinai.

17 ATTORNEY BROOKS: I am entitled to
18 understand the expert's financial interest. And I
19 suggest to you, Counsel, that you'd rather have me
20 questions asked here where you can designate it as
21 confidential than at trial in a public courtroom.

22 ATTORNEY BLOCK: It's not up to me.

23 ATTORNEY BROOKS: You can confer if you
24 want, because that would be the alternative. If you

1 want to step out and confer with your witness, you
2 should do so.

3 ATTORNEY BLOCK: It's not up to me to say
4 what he can and can't say in contravention with an
5 agreement with his employer, and so I think if you want
6 to like obtain like a Protective Order, you know, with
7 him.

8 ATTORNEY BROOKS: We have a Protective
9 Order in place, Counsel.

10 ATTORNEY BLOCK: I know, I'm not
11 representing him in that capacity, though. So if you
12 want to interface with his attorney through Mount Sinai
13 then you can, but I don't have an attorney/client
14 relationship with him for purposes of any employment
15 disputes.

16 ATTORNEY BROOKS: Are you instructing the
17 witness not to answer?

18 ATTORNEY BLOCK: No, I'm not.

19 ATTORNEY BROOKS: Are you refusing to
20 answer?

21 THE WITNESS: I wouldn't be able to
22 answer without including the hospital lawyers.

23 BY ATTORNEY BROOKS:

24 Q. Can you tell me ---?

1 ATTORNEY TRYON: This is Dave Tryon. I'm
2 sorry ---.

3 ATTORNEY BROOKS: Go ahead.

4 ATTORNEY TRYON: May I just also say that
5 I think if the witness is not willing to disclose his
6 financial interest here, that that would be grounds to
7 disqualify him as a witness, which on behalf of the
8 state I would likely pursue. So I would respectfully
9 request that he answer the question.

10 ATTORNEY BLOCK: Dave, on what basis is
11 that grounds to --- he has disclosed everything required
12 by the rules. You're asking for --- he has no financial
13 interest in this litigation.

14 ATTORNEY BROOKS: We don't need to argue
15 the motion right now. The motion seems likely, the
16 motion will be briefed, but we don't --- we got no Judge
17 here, we're not going to be deciding ---.

18 ATTORNEY BLOCK: If you want to file a
19 subpoena as a third-party subpoena for that information
20 with a Court Order, than you're free to do so. He is
21 appearing here as an expert witness on his expert
22 testimony. So you have plenty of discovery tools to
23 obtain that information. And we're not his counsel for
24 that.

1 ATTORNEY BROOKS: I do have discovery
2 tools, including asking him questions at this
3 deposition. I've attempted to do so. You have not
4 instructed him not to answer. The witness has refused
5 to answer. The record is clear.

6 BY ATTORNEY BROOKS:

7 Q. Let me ask you about personally. Does your own
8 income or any bonus you receive depend on any part of
9 the overall revenues of your plan?

10 A. It does not.

11 Q. And does your personal income consist strictly
12 of a salary or also a salary plus fees associated with
13 surgeries performed?

14 A. Exclusively a salary.

15 Q. And your income depends in no way on how many
16 surgeries, you yourself perform?

17 A. That --- well, I don't perform surgeries I'm not
18 an endocrinologist.

19 Q. Pardon me.

20 A. But that's right, it's not revenue based.

21 Q. It's not revenue based in any way?

22 A. In any way. That's right.

23 Q. That is helpful. Do you have any understanding
24 as to the average revenues per patient that your clinic

1 receives for patients who are seeking gender affirming
2 surgery in the clinic?

3 A. We don't characterize it that way. There's a
4 --- there's a wide range of reimbursements or lack of
5 reimbursements across medicine. And gender affirming
6 care includes quite that entire range actually, from
7 mental health, which is under reimbursed, to the
8 surgeries which are --- where there's more money.

9 Q. I've been waiting to hear the flip side of that.

10 A. So yes, so we have that, so I don't think I
11 could give --- I wouldn't --- even were I allowed by the
12 hospital to give you the specifics, I don't know that I
13 would be able to do that on a per patient basis.

14 Q. Can you tell me your total personal income in
15 2021 from --- in any way related to your work in
16 connection with your employment at Mount Sinai?

17 A. So is this something that I'm answering?

18 ATTORNEY BLOCK: I'm sorry, could you
19 restate the question?

20 THE WITNESS: He's asking for my ---
21 you're asking for my salary?

22 BY ATTORNEY BROOKS:

23 Q. I'm asking for your total income, in any way
24 --- in 2021 in any way associated with the clinic at

1 Mount Sinai?

2 A. So we're running into --- so I'm simply on
3 salary, but the specifics of that are also something
4 where I would need to include the Mount Sinai lawyers,
5 because that's part of their practice, and I would have
6 to defer to them.

7 Q. You decline to answer the question about your
8 own personal income?

9 A. Yes.

10 ATTORNEY BROOKS: I won't take time to
11 speak upon it, but I will object.

12 BY ATTORNEY BROOKS:

13 Q. I read in some document that your spouse is an
14 employee of Parexel --- if I'm pronouncing that company
15 correctly.

16 Is that still the case?

17 A. Yes.

18 Q. And does that company derive any revenues from
19 the sales, testing, clinical trials of any
20 pharmaceutical that is used to suppress puberty or is
21 used as a cross sex hormone?

22 A. I don't know the answer. Parexel is a very
23 large back office organization supporting clinical
24 research with many clients. And so you can envision

1 some connection buried in there, but I don't know
2 specifics.

3 Q. Fair enough.

4 ATTORNEY BROOKS: Let me have 54.

5 BY ATTORNEY BROOKS:

6 Q. Let me ask you to turn to paragraph 18 in your
7 expert report, and there in the first sentence you write
8 although the detailed mechanisms are unknown, there is a
9 medical consensus that there is a significant biologic
10 component underlying gender identity, closed quote.

11 Do you see that?

12 A. No, I might have pulled the wrong thing out.
13 Which ---?

14 Q. It's the expert report not the rebuttal?

15 A. Expert report. And it's which paragraph?

16 Q. Paragraph 18?

17 A. Oh, sorry.

18 Q. This is why lawyers number their paragraphs.

19 A. That is wise. All right. Paragraph 18.

20 Q. I'm just calling your attention --- and I have
21 read into the record the first sentence of that
22 paragraph.

23 A. I see it.

24 Q. And picking up on our earlier discussion about

1 consensus. When you say there is a medical consensus,
2 do you mean that all experts in the field agree or do
3 you mean that in your view this is a majority opinion?

4 ATTORNEY BLOCK: Objection to form.

5 THE WITNESS: So when I guess similar to
6 when we talked about guidelines if the question is, is
7 there unanimity, then there is never unanimity, so there
8 you go.

9 BY ATTORNEY BROOKS:

10 Q. Okay.

11 A. I can be a little stronger, though, because the
12 mainstream medical organizations have various statements
13 in this space. So for example, the endocrine society,
14 which is the largest international organization of
15 endocrinologists does actually have a statement where
16 the sum of the modeling for gender affirming care is
17 prefaced with statements that support this.

18 Q. In providing the basis for your opinion that
19 there is such a consensus, you cite only two papers and
20 those only papers that you had written yourself.

21 Did you consider those papers written by
22 yourself to adequately document the existence of the
23 medical consensus?

24 ATTORNEY BLOCK: Objection to form.

1 THE WITNESS: So both of the papers
2 reference reviews with larger bibliographies that
3 reference yet other papers that support the statement.
4 And when we're talking about what's informing the
5 statement, of course, is not limited to the specific
6 papers referenced, so that's part of the reason why I
7 gave that example, for example, the endocrine society's
8 formal statements on the project, which is a consensus
9 view of more people than myself, of course.

10 ATTORNEY BROOKS: Let me mark as
11 Exhibit 16, an article by Aruna Saraswat and others
12 entitled Evidence Supporting the Biological Nature of
13 Gender Identity from 2015 of which Dr. Safer is one of
14 the co-authors.

15 ATTORNEY WILKINSON: Tab 54.

16 | -----

17 (Whereupon, Exhibit 16, Aruna Saraswat
18 Article, was marked for identification.)

19 | ---

20 BY ATTORNEY BROOKS:

21 Q. And Dr. Safer, is that a paper that you --- I
22 guess I see by placement --- had supervisory
23 responsibility for?

24 | A. Yes.

1 Q. Let me --- I learned something in this
2 deposition, so that is good.

3 Let me call your attention to page two and
4 column two, and in the very bottom paragraph ---.

5 ATTORNEY BLOCK: I'm sorry, did you mean
6 200?

7 ATTORNEY BROOKS: I did mean 200. I
8 apologize. That is also the second page.

9 BY ATTORNEY BROOKS:

10 Q. In the bottom --- first column bottom paragraph
11 it states, quote, however it is important to note that
12 most transgender individuals develop a gender identity
13 that cannot be explained by atypical sexual
14 differentiation, closed quote.

15 A. So this is column two.

16 Q. Column one. If I misspoke I apologize.

17 A. I could have misunderstood at this hour.

18 Q. At the bottom paragraph?

19 A. However it is important to note, I'm there, yes.

20 Q. All right.

21 Can you explain to me what is meant by the
22 statement that most transgender individuals have a
23 gender identity that cannot be explained by atypical
24 transgender differentiation?

1 A. So that is referencing, in this context at the
2 time that this was written, the anatomy, genitals,
3 reproductive structures.

4 Q. And let me just --- for purposes of terminology,
5 you said at the time this was written. This is about
6 seven years ago, six years ago?

7 A. 2015, yes.

8 Q. And if you look at the page one, column one
9 abstract. This paper is using the term disorders, in
10 sexual development, and that DSD.

11 Do you see that?

12 A. I do.

13 Q. That was a term that you were comfortable with
14 most recently?

15 A. It was a terminology that I was using that
16 recently, yes.

17 Q. The point here, on page 200, column one, that we
18 were just looking at is, in fact, most transgender
19 individuals do not suffer from any identifiable DSD.

20 Is that what this is saying?

21 A. From a physically identifiable DSD, that is what
22 this is saying, yes.

23 Q. Physically, genetically, hormonally,
24 identifiable by any physical measurement.

1 Correct?

2 ATTORNEY BLOCK: Objection to form.

3 THE WITNESS: So you have to be careful
4 to be not too broad, and part of the reason is the line
5 there is actually blurring. So when I'm sitting here
6 and talking in 2022 I recognize that there is a
7 potential for some blurring in that line. But in 2015
8 it was certainly understood to be how you're saying it.

9 BY ATTORNEY BROOKS:

10 Q. Well, it remains true today, does it not, that
11 the overwhelming majority of transgender individuals do
12 not suffer from any identifiable atypicality
13 genetically, physically or hormonally.

14 Correct?

15 A. Well, that's not how I would say it, because
16 gender identity is a biological phenomenon and so one
17 would predict that as we identify certain correlates or
18 even explanations, than we will have things in that
19 space. But if we're talking about how things were
20 defined in 2015, being transgender was defined as
21 somebody where their gender identity was not aligned
22 with the rest of their biology, and there was no
23 apparent, physical variation either in terms of their
24 anatomy or their chromosomes in terms of their genitals,

1 in terms of their reproductive anatomy or in terms of
2 their chromosomes. So that is how it was defined at the
3 time.

4 Q. Well, today, and using identifiable to mean you,
5 Doctor safer, are able to identify it now, not
6 hypothetically in the future, it remains true that the
7 overwhelming majority of transgender individuals do not
8 suffer from any current identifiable, physical
9 chromosomal or hormonal irregularity.

10 Correct?

11 A. I would say that right now in 2022, it would be
12 true to say that a transgender person does not have an
13 identifiable genital difference almost by definition or
14 a --- or an internal reproductive organ difference
15 almost by definition. Chromosomal I can't say, because
16 we actually don't check. And hormonal gets even grayer
17 than that, because it could be the case that there are
18 hormonal exposures, for example, in utero that explain
19 at, least some people as being transgender.

20 Q. As you sit here today, you don't know of any
21 chromosomal test that can identify an individual as
22 transgender, do you?

23 A. Is there a --- there --- as I sit here today
24 there are no tests to identify somebody who is

1 transgender.

2 Q. And that includes genetic tests?

3 A. There's no scan and there are no blood tests and
4 there are no genetic tests.

5 Q. And no hormonal tests?

6 A. That's right. There are no hormonal tests right
7 now to identify a transgender person.

8 Q. As you sit here today and based on your whole
9 knowledge of the field, there is no biological test from
10 some mental professionals, as they can do, but there is
11 no biological test that will tell you in advance which
12 prepubertal child who is suffering from gender dysphoria
13 would persist and which would desist as they enter
14 adolescence?

15 A. So I would have to challenge how you're stating
16 that a little bit just so that we are cleaner in terms
17 of how we think. So we're thinking right now in terms
18 of identifying kids who are transgender. We use various
19 terminologies, so that --- we've have been using the
20 term gender dysphoria we're going to be shifting to more
21 gender incongruence, but we're trying to identify people
22 who are transgender and who may require intervention
23 later.

24 Recognizing further that only a subset of

1 transgender people would require a medical or surgical
2 intervention. And so if the question is can --- is
3 there a test now in 2022 to determine in an prepubescent
4 kid who says they're transgender or people who suspect
5 may be transgender on whatever they're saying, no, there
6 is no test to know that is true or not and to know if
7 they'll think that later or not, and to know if they'll
8 want treatment or not.

9 Q. So it is your opinion that there is consensus
10 that there is a biological basis for transgender
11 identification, but as of 2022 you don't know with any
12 confidence what that biological basis is.

13 Correct?

14 ATTORNEY BLOCK: Objection to form.

15 THE WITNESS: I would say that it is
16 complicated and there may even be more --- there might
17 be multiple explanations for people being transgender.
18 We see that with other biological entities like
19 diabetes, for example. So the idea that we don't know
20 what it is, is also a little too narrow.

21 BY ATTORNEY BROOKS:

22 Q. You don't know any one identifiable biological
23 cause with any confidence that state within a scientific
24 knowledge?

1 A. No. That's not quite true. We know that ---
2 and it's not even the biology of being transgender even
3 though that is how I just framed it. It is even one
4 step back which is the biology of gender identity. We
5 all have gender identity, and how is that determined and
6 what is that biology. And we know there --- and we know
7 then that some transgender people have that particular
8 biology not aligned with some of their other biology.

9 So going back to what you just asked, that we
10 don't know any mechanisms is not quite true. That is
11 people that looks to be true that exposure to androgen,
12 male hormones in utero can have some influence on some
13 people as to their identity.

14 Q. Well, if there is not yet any test that is
15 predictive of gender identity in a prepubescent child,
16 then as a matter of science it follows that you don't
17 actually know any causal relationship, any biological
18 basis, is that not true?

19 A. No, that wouldn't be quite sure. We can't test
20 for somebody deemed transgender, and we can't test
21 gender identity with a test. But like I said, that at
22 least in some circumstances the androgen exposure in
23 utero, in a mother's womb, could be part of the
24 explanation for some people. Maybe isn't all the

1 explanation for some people.

2 Q. It could be, but no science has been done to
3 prove that that is a fact, has it?

4 A. So it isn't really a hypothetical, that is we do
5 have --- we do have data that support it, but it doesn't
6 lead us to a test.

7 Q. If it is not testable, then it is a hypothesis,
8 not a fact, isn't it, not of science.

9 Correct?

10 ATTORNEY BLOCK: Objection to form.

11 THE WITNESS: No, that is using testing
12 two different ways. So in a scientific study, then a
13 hypothesis is something that you have based on a certain
14 --- based on certain data, but then you test to see how
15 true it might be. But when I was using the word test,
16 I'm talking about like a blood test or something that we
17 could actually do on a given individual to know their
18 circumstance with regard to their gender identity.

19 BY ATTORNEY BROOKS:

20 Q. Let me ask you to look at the paper that I've
21 marked as Exhibit 16, Evidence Supporting the Biological
22 Nature. Is that that which you have in front of you?

23 A. I do, yes.

24 Q. And on the first page you refer under the result

1 that begins by discussion of a seminal study by
2 Meyer-Bahlburg. Do you see that? Second column,
3 beginning of the results section.

4 A. Yes.

5 Q. And is it your contention that the
6 Meyer-Bahlburg study provides evidence of a biological
7 basis for transgender identification?

8 A. What the Meyer-Bahlburg study does is it
9 provides evidence of a biological basis for gender
10 identity.

11 Q. Well, specifically the study, the Meyer-Bahlburg
12 study --- let me have that so we are not shooting in the
13 dark. Exhibit 17 is a paper from 2005 from Professor
14 Heino Meyer-Bahlburg, entitled Gender Identity Outcome
15 in Female Raised 46, comma XY persons with penile
16 agenesis, and it continues. It's a long document?

17 ATTORNEY WILKINSON: Tab 14.

18 ---

19 (Whereupon, Exhibit 17, 2005 Paper by
20 Professor Heino Meyer-Bahlburg, was marked
21 for identification.)

22 ---

23 BY ATTORNEY BROOKS:

24 Q. I believe the level of questions that I will be

1 asking, however, are the ones that you will know off the
2 top of your head given the importance of this study in
3 the field. The study concerned exclusively children who
4 are born with what's referred to as a 46 XY condition.

5 Right?

6 A. Yes.

7 Q. And that is long recognized as a DSD?

8 A. No, 46 XY is the classic male chromosome
9 pattern.

10 Q. Yes. Pardon me. So these are individuals with
11 typical male pattern chromosomes?

12 A. Yes.

13 Q. Who, however, for some reason have had a
14 developmental disorder or defect affecting their
15 genitals?

16 A. Who have had some sort of alteration or
17 development of their genitals, exactly.

18 Q. And the study concerns the results of efforts to
19 raise such genetically male children as female in some
20 cases after surgical procedures to feminize them and in
21 some cases absent surgical procedures.

22 Correct?

23 A. The study really relates to the gender identity
24 of those where there is an attempt to raise them as

1 females.

2 Q. And the results, if I understand the study, were
3 mixed, that is that some of the individuals who were
4 raised as females nevertheless came to identify as male
5 and some of the individuals who were raised as females
6 came --- persisted in identifying as female.

7 Correct?

8 A. It is not actually as clean as you're saying it.
9 So we should look at some of the specifics and we might
10 need to point out to specific sentences, but this too is
11 a survey of --- a survey of studies, to be clear, it's
12 not its own isolated study, and then there --- in none
13 of these studies were they systematic or, you know, I
14 guess I will just use the word systematic in
15 ascertaining that all of the people who were being
16 raised female and ascertaining all of the gender
17 identity of those people. But what they are really
18 observing is that the numbers that they mention of the
19 people who they were trying to raise female who had male
20 gender identity were whatever the numbers were. I don't
21 know if that makes sense, but you'll follow as
22 necessary.

23 Q. If you turn to page 432 it begins under the
24 heading discussion. It begins, quote, the main findings

1 can be summarized as follows. One, the majority of 46
2 XY individuals with presumably normal male prenatal
3 hormonal milieu, comma, non-hormonal anatomic
4 abnormalities of the genitals, comma, and female gender
5 assignment at birth or in early childhood have not
6 changed gender to male. Do you see that?

7 A. I do see it.

8 Q. And one thing, and I understand the
9 qualifications that you've just described this is not
10 recording a carefully structured study performed by
11 Doctor Meyer-Bahlburg but rather a review of case
12 histories.

13 Right?

14 A. Exactly.

15 Q. But his conclusion from his review of those is
16 that the majority of genetically presumably normal male
17 individuals who were raised female, and I believe it's
18 fair to summarize in most cases after feminizing genital
19 surgery, adhered to a female gender identity at least to
20 the data we have?

21 A. Yes, so I don't know whether they actually all
22 had surgery or not.

23 Q. They did not all have surgery.

24 A. Right or even the larger number. I don't know.

1 I would have to go through.

2 Q. Fair enough.

3 A. But the --- and it was his opinion at the time
4 he was writing this that the majority who were reared
5 female were living as female, although we don't know
6 their gender --- but now this is me stepping out, saying
7 we don't know their gender identity, nobody asked. The
8 reason why this paper is interesting is even in the
9 circumstance where they were being so passive in how
10 they were collecting the data, such a large fraction of
11 these individuals were so clear in their male gender
12 identity that they actually identified themselves
13 against the protocols.

14 Q. And that seemed to be evidence that --- of a
15 biologic basis of gender identity congruent with their
16 male genetics.

17 Correct?

18 A. That --- for these people, that's right. That
19 is with or --- with their chromosomes.

20 Q. Right.

21 A. Which you would predict. If we think about ---
22 if we recognize --- if we think that by survey a half a
23 percent or even a full percent of people are transgender
24 that would mean that 99 percent of people are cisgender.

1 And so if you take a population of people with certain
2 chromosomes, 99 percent of them are going to be
3 cisgender and will have a gender identity incongruent
4 with their chromosomes.

5 Q. The study includes no individuals who were
6 raised with a gender identity inconsistent with their
7 male chromosomes who came to identify or later perceived
8 themselves as identifying as female.

9 Correct?

10 A. Well, we don't know that because they were ---
11 they're all XY individuals who were being raised female.
12 And somebody who had a female gender identity who is
13 transgender among them would never be identified as
14 transgender in this case.

15 Q. So my question was a little more specific. The
16 study simply doesn't include any individual who had male
17 chromosomes who was raised male who came to identify as
18 female?

19 A. That's correct. All of these people who are XY
20 chromosome people raised female.

21 Q. And you would agree with me, would you not, the
22 study provides some evidence that external forces such
23 as feminizing surgery or how their parents treat the
24 child can have some influence on the formation of gender

1 identity?

2 A. I can't say that because the study really
3 doesn't go there. The study is only passive observation
4 and all --- the only thing I would say with some
5 confidence is that some fraction of these individuals
6 who are so clear in their gender identity that despite
7 nobody even looking for that sort of thing, because that
8 wasn't even a consideration when these --- when these
9 cases occurred, they --- the individuals spontaneously
10 announced to the authorities around them, parents and
11 doctors, that they were wrong, that the parents and
12 doctors were wrong.

13 Q. And that, in your view, provides at least some
14 evidence of a genetic basis for gender identity
15 congruent with chromosomal sex?

16 ATTORNEY BLOCK: Objection to form.

17 THE WITNESS: No. It provides some
18 evidence of a biological basis for gender identity that
19 can't be manipulated externally.

20 BY ATTORNEY BROOKS:

21 Q. Well, considering that the study included no
22 examples of any individual who adopted a transgender
23 identity inconsistent with how they were raised, the
24 study simply can't provide any information about

1 biologic basis of transgender identification, can it?

2 A. Wait. I think say that again.

3 Q. The study includes no individuals who adopted a
4 gender identity, a transgender identity apart from
5 social transition and, therefore, can provide no
6 information one way or the other about whether there is
7 or is not a biologic basis for transgender
8 identification?

9 A. So not quite. So the --- because remember the
10 point is that gender identity, period, universally, has
11 a biological basis. It's not that we --- and to be
12 clear, I don't even know that we won't find and some
13 people even wonder if we will find a gene that
14 associates a gene with transgender, per se. But I'm not
15 even saying that. If there's --- I'm only saying that
16 we will find let's say genes associated with gender
17 identity and not everybody will have them aligned with
18 the rest of their biology. So I just want to preface
19 with that.

20 And in this particular review, they're taking
21 people who have XY chromosomes exclusively. So
22 therefore, if one --- if a certain fraction of them were
23 to have female gender identity despite assuming
24 different development they would have had male --- they

1 would have had other male biology, those are the people
2 we would have categorized as transgender using current
3 definitions. And those individuals would not have been
4 apparent in this study they were being raised female
5 anyway.

6 Q. And my point was that, therefore, that this
7 study can't provide any information about whether there
8 is or isn't a biological basis for transgender
9 identification?

10 A. So yes. I guess how you are framing that is
11 where I'm pushing back. So the point of this study is
12 as evidence of there being a biological basis of gender
13 identity period, having nothing --- not necessarily for
14 being transgender. In fact, I don't even know if there
15 --- yeah, I don't even know if that would be the model.
16 The model would be somebody who has a certain gender
17 identity, a certain other biology, and then that
18 combination is what we are calling transgender.

19 Q. You also referenced a paper by Doctor Reiner.
20 And let me have that.

21 ATTORNEY BROOKS: And I will mark that as
22 Exhibit 18, 2004 Discordant Sexual in Some Genetic Males
23 With Cloacal Exstrophy Assigned to Female Sex at Birth.

24 ATTORNEY WILKINSON: Tab 71.

1

2

(Whereupon, Exhibit 18, Paper by Doctor

3

Reiner, was marked for identification.)

4

5

BY ATTORNEY BROOKS:

6

Q. And Dr. Safer, you are well familiar with this
7 paper.

8

Am I correct?

9

A. I am, yes.

10

Q. And this is the only other paper that you cite
11 for the assertion that gender identity has a biological
12 basis.

13

Am I correct?

14

A. No, there are a range of categories of papers,
15 but these are two of my favorite papers in the first
16 category, which is the category of attempting to
17 manipulate gender identity externally.

18

Q. Dr. Bahlburg in his paper, on page 433 of
19 Exhibit 14, in column one ---.

20

A. Yes. Let me get there.

21

Q. Yes. 433, column one.

22

A. 433, column one.

23

Q. He says about two inches off the bottom,

24

referring to the Reiner and Gearhart paper of 2004,

1 which I believe is this paper, he says, quote, it has
2 serious methodological flaws. Do you agree with that
3 statement?

4 A. Let's read what he is criticizing. All these
5 papers have their weaknesses. All right. So the
6 remainder of that --- so the remainder of the paragraph
7 is --- details the complaints for Doctor Meyer-Bahlburg,
8 where his --- which I focus as a social science
9 researcher that they didn't do various assessments that
10 would make it --- that would make standard people doing
11 some of this research able to replicate some of the
12 items in the paper. And I will --- so while Doctor
13 Meyer-Bahlburg may be frustrated and be complaining
14 about that, he is not actually attacking the veracity of
15 their results.

16 Q. Well, the point was serious methodological flaws
17 is you are not really able to evaluate the veracity of
18 the results.

19 Correct?

20 A. Not necessarily.

21 Q. Do you agree with Doctor Meyer-Bahlburg's
22 evaluation that the methodology of the study reported by
23 Reiner and Gearhart suffers from serious methodological
24 flaws?

1 A. No.

2 Q. So let's summarize this study if I may. I'm
3 turning to page 334.

4 A. And extending that too, part of his frustration
5 wouldn't be my frustration because I am not looking for
6 those particular endpoints, that is for my purposes for
7 determining whether gender identity is a biological
8 basis Reiner and Gearhart's paper is actually quite
9 strong.

10 Q. Let's look at the first page in the summary up
11 front. It refers to this paper dealt with 16 --- under
12 methods, 16 genetic males.

13 Correct?

14 A. Yes.

15 Q. And these were all males who suffered from ---
16 uses the word in the second line of the background as
17 severe developmental disorders affecting their genitals.

18 Correct?

19 A. That's how it is phrased here. Where am I
20 seeing that?

21 Q. The second line of the background says severe.

22 A. Severe phallic inadequacy, yes, I see that.

23 Q. Which is to say not --- absent or severely
24 disformed penis?

1 A. That's what that means, yes.

2 Q. Okay.

3 But these are individuals who are genetically
4 male, and more than that, on page 334, column two,
5 two-thirds of the way down it says the testes were
6 histologically normal in all 14 when examined?

7 A. I'm on column two.

8 Q. It is column two.

9 A. I apologize.

10 Q. You can kind of see where my finger is pointing
11 here.

12 A. And this is under ---.

13 Q. Under methods and the paragraph that begins
14 parents to be educated?

15 A. Testes were histologically normal in all 14.
16 I'm there, yes.

17 Q. So we had individuals who were genetically male
18 that had normal testes and had severe deprivation of
19 their penis or it was absent?

20 A. Yes.

21 Q. And what was done to these 14 subjects, looking
22 just above that, is that they were assigned a female sex
23 surgically by means of orchiectomy and construction of
24 vulva.

1 Right?

2 A. Yes.

3 Q. And orchiectomy is another medical term for what
4 the layman thinks of as castration?

5 A. As removing the testes.

6 Q. And construction of the vulvi is creating a ---
7 I'm not sure what the right term is, a pseudo vagina?

8 A. It wouldn't be a pseudo vagina, but creating a
9 vagina.

10 Q. It says that --- just immediately following the
11 description of the surgery 14 of these 16 --- looking
12 back at the results paragraph and the abstract, 14 of
13 these 16 were assigned female but later declared
14 themselves male despite the surgery, despite being
15 raised as female.

16 Right?

17 A. Right, 8 of the 14 who were assigned female.

18 Q. I'm sorry, I misread that. Thank you. Eight of
19 the 14 who were assigned female nevertheless declared
20 themselves male at some stage?

21 A. That's correct.

22 Q. And the two who had been raised as males, even
23 though they suffered the same type of phallic
24 developmental defect, remained identifying as males.

1 Correct?

2 A. Yes.

3 Q. There was an --- whatever assignment was made,
4 this was made to infants. It wasn't made or based on
5 any choice or reported sense on the part of the child?

6 A. That's exactly right, yes.

7 Q. So several of these individuals, specifically
8 six, who were assigned female at least throughout the
9 period identified by this study adhered to a female ---
10 living out the female gender identity?

11 A. Actually it was five because one of the children
12 refused to have contact with the surgeons when some of
13 these conversations began to take place.

14 Q. So we know that five --- we don't know what that
15 person was thinking, feeling or identifying --- but we
16 know that five ---?

17 A. They were angry.

18 Q. They were angry. Whichever that came out, I'd
19 be angry, so ---

20 A. Yes.

21 Q. --- so 5 of the 14 subjects who were assigned
22 female and surgically transitioned and socially
23 transitioned continued to at least physically identify
24 as female?

1 A. As of when they wrote the paper they were still
2 identifying as female as far as I remember. That's
3 right.

4 Q. And it would be your position that visibly
5 identifying as female doesn't necessarily mean that they
6 were generally transgender?

7 A. That --- we don't know that because that wasn't
8 asked.

9 Q. Is it your view that if you had these children
10 who were surgically transitioned, socially transitioned
11 visibly identifying as female, that if you had simply
12 asked them you would have found out the undoubted truth
13 about their gender identity?

14 ATTORNEY BLOCK: Objection to form.

15 THE WITNESS: So it is true that as
16 people develop and assuming that there are good language
17 skills and that there aren't other developmental, mental
18 developmental reasons or other mental health reasons why
19 people would not be clear, that people are able to
20 articulate their gender identity. Certainly adults do
21 so apparently quite reliably and older teenagers the
22 same, so depending on age. But yes, there would be a
23 point in time when you could simply ascertain that by
24 asking.

1 BY ATTORNEY BROOKS:

2 Q. Dr. Safer is that fundamentally a medical
3 question or a psychology/mental health question? The
4 question of the reliability of a patient's self report?

5 A. I don't know that I separate it that way. I say
6 that based on the data we slowly develop overtime of
7 transgender people where we see that any absence of
8 other confounding items along the lines that I said,
9 people at a certain stage in maturity who tell you a
10 certain thing about their gender identity are consistent
11 in that regard.

12 Q. This study, the Reiner Gearhart study,
13 Exhibit 18, concerns --- looks at the effect of trying
14 to raise individuals in a gender identity discordant
15 with their chromosomal sex.

16 Correct?

17 A. It is discorded with quite a number of things,
18 but yes, chromosomal is one of your hard data points.

19 Q. This study does not look at the question about
20 whether and when or how any sort of intervention might
21 encourage development of a gender identity consistent
22 with one's genetics sex; does it? It simply does not
23 look at this issue?

24 A. Say that again, sorry.

1 Q. This study does not address the question of
2 whether or how or at what developmental stage
3 therapeutic interventions might encourage the
4 development of a gender identity consistent with one's
5 chromosomal sex?

6 A. The study is --- the way I'm interpreting the
7 study is it's looking at our inability to manipulate
8 gender identity. And it's just that. And I'm a little
9 fuzzy on the rest of what you're asking me.

10 Q. Well, the study looks at efforts to manipulate
11 gender identity away from chromosomal from the identity
12 normally associated with one's chromosomal sex. In this
13 case the male sex.

14 Right?

15 A. It does.

16 Q. This study simply does not look at efforts to
17 manipulate gender identity towards alignment with the
18 identity normally associated with a subject's
19 chromosomal sex?

20 A. I think I'm following you now. So you're
21 suggesting that if we took a transgender person and
22 tried to manipulate their gender identity to align with
23 some of the rest of their biology?

24 Q. I'm not suggesting that I'm simply saying this

1 study.

2 A. That particular instance. Yes.

3 ATTORNEY BROOKS: 15. It is one of the
4 previous marked ones, if that matters. All right.

5 I will not show you that document. Let
6 me ask the court reporter how many --- how much time we
7 have left on the clock.

8 COURT REPORTER: I have 5:52, five hours
9 and 52 minutes.

10 ATTORNEY TRYON: I didn't hear that.
11 Could you repeat that?

12 ATTORNEY BROOKS: We've got an hour and
13 eight minutes according to the clock of the court
14 reporter here, and I believe that our friend in the
15 ether is calculating separately.

16 VIDEOGRAPHER: Correct. And it sounds
17 like the same. I have to do the math.

18 ATTORNEY BROOKS: Okay.

19 BY ATTORNEY TRYON:

20 Q. Are you familiar Dr. Safer with a paper recently
21 published by Lisa Littman of Brown University looking at
22 the surveying 100 teens or young adults --- actually
23 surveying a hundred individuals who report having
24 de-transitioned and gone from identifying as transgender

1 to identifying in a manner consistent with their genetic
2 sex?

3 ATTORNEY BLOCK: Objection to form.

4 THE WITNESS: So I'm aware of Dr. Littman
5 having written a second paper. But I'm not facile, I
6 guess.

7 BY ATTORNEY BROOKS:

8 Q. You haven't read that paper?

9 A. I have not read the paper. I probably did read
10 it, but I would not be able to be quizzed on it.

11 Q. Then I won't quiz you on it. I always tell
12 witnesses I don't know is the easiest way out of a line
13 of questioning.

14 Are you --- let me ask you this, does your
15 clinic have any procedure in place to track outcomes on
16 patients on whom you perform gender conforming surgery
17 long term?

18 A. We're actually in the --- we have a couple of
19 processes, so I guess the short answers are yes and
20 we're going to be more rigorous going forward.

21 Q. Do you have any knowledge as to how many
22 patients on whom your clinic has performed surgery have
23 after that surgery committed suicide?

24 A. I don't off the top of my head know that.

1 Q. Do you believe that your clinic possesses
2 reasonably complete information on that question?

3 A. I actually don't think our information is
4 sufficiently complete currently, and that actually is an
5 area where we're going to develop more vigorously,
6 because I would actually like to know that.

7 Q. Do you know whether any patients on whom your
8 clinic has performed surgery has subsequently sought to
9 de-transition and take on or revert to, whichever way
10 you want to see it, a gender identity that's aligned
11 with their chromosomal sex?

12 A. So it's a complicated question. And actually I
13 just want to go back to the first part where you were
14 talking about suicide.

15 To be clear, the rigor I'm talking about is not
16 suicide focused, because I actually am not anticipating
17 that that is --- that that is happening or is happening
18 more than with being seen in a general population, but
19 for all encompassing that we do definitely need that.

20 But back to your current question ---.

21 Q. Let me jump back to suicide for a moment. Are
22 you aware of studies coming out of DeVry University and
23 Amsterdam suggesting that post-surgical transgender
24 populations continues to experience elevated rates of

1 complete suicides compared to controlled populations?

2 ATTORNEY BLOCK: Objection to form.

3 THE WITNESS: So I'm aware that
4 transgender people have more mental health morbidity
5 than other populations. Once corrections are made for
6 other confounding factors I don't know that we would
7 have --- that we're very clear yet on those data
8 including ---.

9 BY ATTORNEY BROOKS:

10 Q. When I refer to a published study coming out of
11 DeVry University of Amsterdam showing high rates of
12 suicidality in postsurgical transgender patients, you
13 believe you're familiar with that literature?

14 A. I guess it would fall in the same category as
15 Littman's second paper.

16 Q. Okay.

17 A. Where I'm familiar with the fact that they're
18 doing surveys and I'm familiar with the broad outlines,
19 but could not ---

20 Q. Okay.

21 A. --- comment on specific studies without it being
22 in front of me.

23 Q. And have any patients on whom your clinic has
24 performed surgery subsequently decided to de-transition

1 and assume a gender identity aligned with their
2 chromosomal sex?

3 A. I don't --- I don't know. There is absolutely
4 the case that there are people who stop their treatment
5 at different levels, so it has definitely been my
6 experience that I have patients who I've put on hormone
7 treatments who have stopped those hormone treatments.
8 And there are also, among our patients --- I don't know
9 if any of the patients where we performed the original
10 surgery they actually were opting for a different
11 surgery, but we definitely have patients who have come
12 to us, who had a surgery done elsewhere who were looking
13 for a degree basically what you're calling a reversal,
14 to the degree that that's possible. So that such a
15 thing does exist. So the point about saying that they
16 have a different gender identity, that would --- that is
17 not typically how the patients come saying it. They
18 don't say, oh, it turns out my gender identity is not
19 that. It's more often society is not treating me well,
20 this isn't working out. That's the more --- that's the
21 --- that's the typical scenario. I mean, yes, we
22 definitely have seen that circumstance.

23 Q. Dave Tryon, who is with us remotely as Counsel
24 for West Virginia, I have promised him an hour, so I

1 have to stop, even though I have so many more
2 interesting questions.

3 ATTORNEY BROOKS: So Dave, I will stop
4 and I will turn the witness over to you.

5 ATTORNEY BLOCK: Could we take a break
6 now?

7 ATTORNEY BROOKS: Of course, it is a good
8 time for sure.

9 ATTORNEY BLOCK: Thanks. Can we go off
10 the record?

11 VIDEOGRAPHER: The time is 5:03 p.m.
12 Eastern Standard Time.

13 OFF VIDEOTAPE

14 ---

15 (WHEREUPON, A SHORT BREAK WAS TAKEN.)

16 ---

17 ON VIDEOTAPE

18 VIDEOGRAPHER: We are back on the record.
19 The current time reads 5:25 p.m. Eastern standard Time.

20 ATTORNEY BLOCK: This is Josh Block on
21 behalf of the Plaintiff. We have conferred off the
22 record, including with counsel from Mount Sinai, and
23 Doctor Safer can answer the two questions he declined to
24 answer before provided that we mark those portions of

1 the deposition transcript confidential, and all counsel
2 for Defendants have agreed with that.

3 ATTORNEY BROOKS: And this is Roger
4 Brooks, and yes, I confirm that all counsel for
5 Defendants have agreed to that.

6 CONFIDENTIAL PORTION BEGINS
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EXAMINATION

BY ATTORNEY TRYON:

Q. Hello, Dr. Safer. Thanks for your time today.
So I am David Tryon. I represent the State of Virginia.
I'm appointed by the Attorney General's Office. And I
wanted to start out by looking at --- asking you to take
a look at your Rebuttal Report. I don't recall what
exhibit number that is. If you could tell us what it is
marked?

ATTORNEY WILKINSON: Exhibit 2.

ATTORNEY TRYON: Exhibit 2.

ATTORNEY WILKINSON: Tab 51.

THE WITNESS: I have that in front of me.

BY ATTORNEY TRYON:

Q. Could you take a look at paragraph six, please?
Do you have that in front of you?

A. Yes.

Q. Great. Now, in here it says in the second or
maybe third sentence as reflected in the same source
cited by Doctor Brown dimorphous sexual characteristics
in men and women are produced by a combination of genes,
prenatal androgen exposure to sex hormones. And I'd

1 like to focus on that particular clause. Can you
2 explain what prenatal androgen exposure to sex hormones
3 is?

4 A. Yes. That references --- I guess to me it's
5 more or less exactly what it says, which is that the
6 developing fetus is exposed to various hormones and
7 other factors and androgen is specifically the male ---
8 is typically what we consider to be the male sex
9 hormone, although everyone has some. And then prenatal
10 just means and in utero or in the mother's womb.

11 Q. So androgen for males is testosterone.

12 Is that right?

13 A. Androgen in general is that category of hormones
14 that we think of as typically male, even though, like I
15 said, we all have them. And one of the androgens is
16 testosterone. And with adults it is the one that we are
17 talking about most of the time, of course.

18 Q. Okay.

19 So as I understand it, your suggestion is that
20 that prenatal exposure to testosterone can have an
21 impact even after birth.

22 Is that right?

23 ATTORNEY BLOCK: Objection to form.

24 THE WITNESS: So all factors --- well, I

1 don't want to overstate it, but factors that occur to
2 which a fetus is exposed in the womb have impact on the
3 development of that fetus, of that person when they are
4 born, and so androgens, including testosterone, would be
5 part of that, so yes.

6 BY ATTORNEY TRYON:

7 Q. So are you aware of studies addressing the
8 impact of prenatal exposure to testosterone as it
9 impacts people after their birth?

10 ATTORNEY BLOCK: Objection to form.

11 THE WITNESS: I think I need you to be
12 specific about which studies.

13 BY ATTORNEY TRYON:

14 Q. Are you aware of any study that addresses the
15 effect of prenatal testosterone upon boys after they're
16 born?

17 ATTORNEY BLOCK: Objection to form.

18 THE WITNESS: So the ---.

19 BY ATTORNEY TRYON:

20 Q. Or men?

21 A. So I can --- I guess --- I have to --- kind of
22 two answers. Exposure to prenatal androgens, kind of
23 generally because it is not always, testosterone explain
24 the development of what we consider to be typically male

1 genitalia so that all babies born with what --- with a
2 penis and with a urethra that is the part for which you
3 urinate, that's up inside the penis and having the
4 gonads, which would typically be testes in the scrotum,
5 all of that happens in response to testosterone.

6 BY ATTORNEY TRYON:

7 Q. And then that also triggers a question I had.
8 You had previously said in your original report a
9 person's genetic makeup and internal and external
10 reproductive anatomy are not useful indicators of
11 athletic performance and have not been used in a league
12 competition for decades.

13 My question on that is, when you say a person's
14 genetic makeup doesn't their genetic makeup trigger
15 whether or not they are going to --- a person's genetic
16 makeup will determine whether or not they're a boy or a
17 girl, and therefore if they're a boy that would trigger
18 their generation of more testosterone than a girl.

19 Is that a fair statement?

20 ATTORNEY BLOCK: Objection to form.

21 THE WITNESS: Yeah, no, that's --- so I
22 think I need to walk that back a little bit. Why don't
23 we --- can we do it like piece by piece or have you
24 restate parts?

1 BY ATTORNEY TRYON:

2 Q. I will restate it. So when you say a person's
3 genetic makeup, what does that mean?

4 A. Mostly in this context I'm referencing their
5 chromosomes that's the specific that in the further past
6 was actually being used to identify people which we no
7 longer do. It's not sufficiently reliable.

8 Q. Does the --- you have an X Y chromosome that is
9 typically considered to mean that you're a male.

10 Correct?

11 A. The XY chromosome is typically considered to
12 mean that you're a male, correct.

13 Q. And that would mean that you would be generating
14 more testosterone than if you have an X chromosome.

15 Right?

16 ATTORNEY BLOCK: Objection to form.

17 THE WITNESS: So the presence alone of
18 that XY pattern is insufficient to know with certainty
19 that you're producing more testosterone and that is part
20 of the point of I'm saying it is that biological sex is
21 more complex, and you could have the gene for the testes
22 that produce testosterone elsewhere, and then you
23 wouldn't have that pattern and you still would be
24 producing the testosterone or vice versa.

1 BY ATTORNEY TRYON:

2 Q. Okay.

3 Well, let's go back to prenatal testosterone.
4 So you're not --- if I understood what you're saying
5 before, you're not aware of any studies that show
6 whether or not prenatal testosterone would have --- let
7 me just start that over again.

8 Are you aware of any studies that address
9 whether prenatal testosterone has impact on sporting, on
10 athletics in children after birth?

11 A. Correct. That would be right to say that there
12 are no studies of which I'm aware that can associate
13 prenatal testosterone with athleticism. And I don't
14 know what levels we're even talking. Like an adult
15 level? What's your question there?

16 Q. My next question is, have you heard of the
17 Journal of Sports Science and Medicine?

18 A. I guess you would have to show it to me.

19 Q. Okay.

20 Have you ever heard the name Jim Goldby or
21 Jennifer Mays?

22 A. No.

23 ATTORNEY TRYON: Jake, could you bring up
24 the Exhibit that I sent to you today, which is the

1 General Sports Science and Medicine?

2 ATTORNEY WILKINSON: Do you see anything?

3 THE WITNESS: I don't see anything. Oh,
4 that's too small. Okay. That's okay.

5 ATTORNEY TRYON: Okay.

6 And this will be Exhibit --- what Exhibit
7 are we on Jake, do you know?

8 VIDEOGRAPHER: This is 19.

9 ---

10 (Whereupon, Exhibit 19, Article, was
11 marked for identification.)

12 ---

13 ATTORNEY TRYON: I'm sorry, 19?

14 VIDEOGRAPHER: Correct.

15 BY ATTORNEY TRYON:

16 Q. Okay.

17 I take it from your earlier answers, you
18 probably never seen it before.

19 Is that right?

20 A. I certainly don't recall. I don't want to state
21 definitively I've never seen it either, but it's
22 certainly not a paper that I'm going to know off the top
23 of my head.

24 Q. Well, let me ask you to take a look at the

1 conclusion on page 449?

2 A. So can we move the pictures because they're
3 blocking.

4 Q. Can you see it?

5 A. We're getting there. And then is there a way to
6 move that? Oh perfect. Yes.

7 Q. Okay.

8 The conclusion says, current paper provides
9 initial support from an association between prenatal
10 testosterone levels and mental toughness, optimism, goal
11 orientations, coping strategies and hostility, period.
12 Findings tentatively suggest that the mentioned
13 psychological characteristics may be partially
14 biologically predetermined.

15 Do you see that?

16 A. I do see it, yes.

17 Q. Do you have any reason to believe whether that's
18 true or not true?

19 ATTORNEY BLOCK: Objection. I just
20 object to asking him about a conclusion when he just has
21 a little snippet of that and hasn't reviewed the
22 article. And I'm not even sure if it has been cited in
23 the other expert reports.

24 THE WITNESS: I certainly can ---.

1 BY ATTORNEY TRYON:

2 Q. Go ahead.

3 A. I certainly cannot say if that conclusion has
4 any logic to it without knowing the study.

5 Q. Understood. Is it possible since this
6 particular study suggests there is an impact on adults
7 by prenatal testosterone? Is it that prenatal
8 testosterone could also have a DSD explanation for why
9 should boys at 11 years old have more athletic ability
10 than girls?

11 ATTORNEY BLOCK: Objection to form.

12 THE WITNESS: So speaking --- yeah,
13 speaking as an expert, I can't give you an expert
14 comment there without seeing their study.

15 BY ATTORNEY TRYON:

16 Q. Okay.

17 So you just can't say one way or the other.

18 Correct?

19 ATTORNEY BLOCK: Objection to form.

20 THE WITNESS: I mostly wouldn't want to
21 comment on their study. I will only make the
22 observation that the data of which I am aware do not
23 show differences for prepubertal children, if that was
24 part of your question.

1 BY ATTORNEY TRYON:

2 Q. And so the performance data that Dr. Handelsman
3 pointed out showing that there are some damages given
4 before puberty, you reject those?

5 ATTORNEY BLOCK: Objection to form.

6 THE WITNESS: So those broad
7 cross-sectional studies don't get at input, whether they
8 are referencing biological explanations versus societal
9 explanations.

10 BY ATTORNEY TRYON:

11 Q. Okay.

12 Whether it's societal or biologic explanations,
13 Handelsman still demonstrated that there is an advantage
14 for pre-pubescent males over females in athletics.

15 Right?

16 ATTORNEY BLOCK: Objection to form.

17 THE WITNESS: No, neither Dr. Handelsman
18 in his paper --- he doesn't actually say that. And if
19 you --- I think we looked previously at one of the
20 figures where specifically the range of outcomes, if you
21 were to repeat the study, included the girls doing
22 better than the boys.

23 BY ATTORNEY TRYON:

24 Q. Well, that was only one of them. That was not

1 it. That was one of the charts. The other chart showed
2 that there was an advantage, right?

3 ATTORNEY BLOCK: Objection to form.

4 THE WITNESS: The other --- yeah, let me
5 think with that one. Right. We are not getting into
6 what the causality is, then the other charts did show
7 the boys doing better. And again, the caveat remains
8 what is not --- what is not demonstrated there is that
9 there is --- that that is a biological thing versus
10 simply the very longstanding societal and cultural
11 environments.

12 BY ATTORNEY TRYON:

13 Q. And you've contended that there's a biological
14 component to gender identity.

15 Correct?

16 A. Yes.

17 Q. Which we have not been able to identify in this
18 deposition.

19 Correct?

20 ATTORNEY BLOCK: Objection to form.

21 THE WITNESS: So it is not quite --- well
22 I actually don't know what's been identified in the
23 deposition. The data are included in my --- in the
24 papers that I referenced that are what are convincing to

1 the medical community right now. The detailed
2 explanations for the specific biology are not known if
3 that's where you're going.

4 BY ATTORNEY TRYON:

5 Q. Assuming there is actually a biological
6 component, as you say, to gender identity, that says
7 nothing about whether a biological male identifying as a
8 female should, as a public policy matter, be allowed to
9 participate on a girls athletic team in high school and
10 middle school.

11 Right?

12 ATTORNEY BLOCK: Objection to form.

13 THE WITNESS: So the way that I would say
14 that is even if we recognize that there is a biological
15 explanation for gender identity, that does not --- well,
16 I don't know that then I can go on to make an expert
17 statement, honestly, because that gets outside my
18 purview and in terms of --- my lane is just simply to
19 say that.

20 BY ATTORNEY TRYON:

21 Q. Got it. Can you look at your rebuttal report
22 and look at page two?

23 A. I have my rebuttal in front of me and I'm on
24 page two.

1 Q. Paragraph 4B?

2 A. I have that in front of me.

3 Q. You say --- great. You say circulating
4 testosterone is the primary known biological driver of
5 average differences in athletic performance. Do you see
6 that?

7 A. I do.

8 Q. You say it is primary so what are the other
9 biological drivers of average differences in athletic
10 performance?

11 ATTORNEY BLOCK: Objection to form.

12 THE WITNESS: So when I --- so we're
13 talking about circulating testosterone --- let me just
14 look at this. Right. The truth is, is that it may ---
15 that the only candidates that we have so far are
16 testosterone at puberty and testosterone in the moment.

17 BY ATTORNEY TRYON:

18 Q. So it's --- according to you, it's testosterone
19 at puberty and circulating testosterone are the only
20 biological drivers of average differences in athletic
21 performance.

22 Is that right?

23 A. So excuse me. I'm actually --- so this is the
24 president of the hospital.

1 ATTORNEY BLOCK: I'm sorry. Can we go
2 off the record for a minute and take a break. The
3 president of the hospital is returning his previous
4 call.

5 VIDEOGRAPHER: Going off the record. The
6 current time is 5:48 Eastern Standard Time.

7 OFF VIDEOTAPE

8 - - -

9 (WHEREUPON, A SHORT BREAK WAS TAKEN.)

10 - - -

11 ON VIDEOTAPE

12 VIDEOGRAPHER: Back on the record. The
13 current time reads 5:54 p.m. Eastern Standard Time.

14 BY ATTORNEY TRYON:

15 Q. My last question was according --- according to
16 you, testosterone at puberty and circulating
17 testosterone are the only biological drivers of average
18 differences in athletic performance.

19 Is that right?

20 A. Right, they are the only ones that are known.

21 Q. And in paragraph 4C, looking on page three ---
22 let's move over to page three, at the top of the page,
23 your statement is there is no basis to expect that
24 transgender girls who receive puberty delaying

1 medication followed by gender affirming hormones would
2 have an athletic advantage. There's a comma. But if we
3 just put a period there, is that your opinion?

4 A. That is correct. Yes, that is my opinion.

5 Q. Let me ask you the converse. You say there is
6 no basis to expect that transgender girls who receive
7 puberty delaying medication followed by gender affirming
8 hormones would not have an athletic advantage, period.
9 Would you agree with that statement?

10 A. No.

11 Q. Do you have any --- excuse me, any performance
12 data from an actual athletic event that support your
13 opinion?

14 A. I do not have any data from an actual athletic
15 performance study for that. No, I do not in that
16 context, in that specific instance.

17 Q. Let me ask you to look at your report. Turn to
18 paragraph 45.

19 A. So my report, paragraph 45. All right. I have
20 that in front of me.

21 Q. Great. Finally, unlike elite international
22 competition, schools and colleges often provide athletic
23 competition as part of a broader educational mission.
24 In that context, when scholastic athletics are

1 components of the educational process, institutions may
2 adopt policies designed to emphasize inclusion and to
3 provide the most athletic opportunities to the greatest
4 number of people. You see that.

5 Right?

6 A. I do.

7 Q. So these policies you referred to are designed
8 to emphasize inclusion and to provide the most athletic
9 opportunities to the greatest number of people, what's
10 the source of that policy? Did you come up with that or
11 did you see it someplace else?

12 ATTORNEY BLOCK: Objection to the form.

13 THE WITNESS: So the question is how am I
14 aware? Yeah --- I apologize. You can hear that I'm
15 confused on your question.

16 BY ATTORNEY TRYON:

17 Q. I'll try and do better. You said intuitions may
18 adopt policies designed to emphasize inclusion and to
19 provide the most athletic opportunities to embrace a
20 number of people. And those policies that you're saying
21 there, is that a policy that you read about somewhere or
22 something you are just suggesting? What's the source of
23 that?

24 ATTORNEY BLOCK: Objection to form.

1 THE WITNESS: So an operative word in
2 this is may adopt policies, so this isn't referencing a
3 specific policy that I would give you right this moment,
4 if that's what you are asking.

5 BY ATTORNEY TRYON:

6 Q. So right, just aside from education --- this
7 whole paragraph is talking about education, but you're
8 not an expert on education or teaching methodology, are
9 you?

10 A. I certainly am not.

11 Q. And you don't have any degrees in education or
12 training in teaching methodology, do you?

13 A. I do not.

14 Q. And you have no degrees or training in pedagogy?

15 A. I have no degree in pedagogy. I will be careful
16 how absolutely I do not, because that's not my ---
17 that's not where I am representing myself to be an
18 expert. I am involved in some education, but at the
19 scholastic level not, so let's just say no.

20 Q. And you have no expertise as to whether sports
21 or how sports are used as part of educational systems.

22 Right.

23 A. Correct. That is not the expertise. The how
24 and my decisions among this are not my expertise.

1 Q. Do you have any idea how many schools actually
2 have sports programs?

3 ATTORNEY BLOCK: Objection. I couldn't
4 hear the full question. You cut out.

5 BY ATTORNEY TRYON:

6 Q. Sorry. Do you have any idea how many schools
7 have sports programs?

8 A. I could not give you a number, no.

9 Q. Are you aware that some colleges do not have
10 athletic programs?

11 A. I guess I'm vaguely aware. If you're asking me
12 as an expert than I wouldn't comment on that as an
13 expert, but as a human in society I certainly am aware
14 that that is a thing.

15 Q. Okay.

16 And do you have any idea what percentage of
17 kids are in athletic programs in schools versus those
18 that are not that are still students?

19 A. No, I would not be your source for that data
20 point.

21 Q. So when you are expressing this opinion in
22 paragraph 45 that's not an expert opinion there, is it?

23 ATTORNEY BLOCK: Objection to form.

24 THE WITNESS: So right, I guess it's a

1 bit confusing here, because it's not my expert opinion
2 that --- well, I'm certainly aware as an individual that
3 this is a priority and when I sit on --- when I sit on
4 committees where we discuss relative priorities, there
5 are experts present who discuss these priorities. But
6 if I'm speaking to you as an expert, then I --- then I
7 can't be the representative expert in that space.

8 BY ATTORNEY TRYON:

9 Q. Right. Well, I'm just asking, in paragraph 45,
10 given your lack of expertise and education, you are not
11 giving an expert opinion in paragraph 45.

12 Is that a correct statement?

13 ATTORNEY BLOCK: Objection, asked and
14 answered.

15 THE WITNESS: So I'm simply --- I'm
16 raising all of the issues that we know exist, but then
17 I'm not providing an expert opinion in terms of the
18 relative priorities among these circumstances that
19 exist.

20 BY ATTORNEY TRYON:

21 Q. Let me just ask you very clearly is paragraph 45
22 an expert opinion of yours?

23 ATTORNEY BLOCK: Objection to form.

24 THE WITNESS: I don't think I'm even

1 expressing an opinion in paragraph 45, expert or
2 otherwise. I'm simply stating the background situation.

3 BY ATTORNEY TRYON:

4 Q. Okay.

5 But --- okay. I would ask you to turn to
6 paragraph 37 of your report.

7 A. All right.

8 I have that in front of me.

9 Q. This is talking about the International Olympics
10 Committee. Right? Let me move back to paragraphs 35
11 and 36.

12 A. Yes, this is the International Olympic
13 Committee. This relates to the International Olympic
14 Committee.

15 Q. So this 2021 framework, do you believe that you
16 understand this framework?

17 A. I think you'll have to ask more specific
18 questions because I might understand parts and I might
19 have questions about parts.

20 Q. Very good. First of all, it says the 2021
21 framework further provides that, quote, any restrictions
22 arising from eligibility criteria should be based on
23 robust and peer-reviewed research that, A, demonstrates
24 a consistent, unfair, disproportionate competitive

1 advantage with performance and/or an unpreventable risk
2 to the physical safety of other athletes. You see that
3 part, right?

4 A. I do, yes.

5 Q. Do you understand what the word disproportionate
6 means in this context?

7 A. To a degree.

8 Q. Okay.

9 What do you understand it to mean when it says
10 a disproportionate competitive advantage in performance?

11 A. The IOC is aware that there's quite a wide range
12 of advantages with different body types and different
13 biology, and so they use language like disproportionate
14 when they want to talk about something that's --- that's
15 --- that's systematically associated with one
16 circumstance in a way that they think would violate the
17 rules, whatever they might be, for a specific sport.

18 Q. That's pretty ambiguous. I have no idea what
19 that means. Let me see if we can narrow it down. Is a
20 disproportionate competitive advantage in performance
21 --- would 20 percent be a disproportionate competitive
22 advantage?

23 ATTORNEY BLOCK: Objection to form.

24 THE WITNESS: So that's --- I can't

1 answer that, because it depends on context, and I'm not
2 the person who wrote the specific language in that
3 document, so that is the quote from the document. But
4 in terms of --- I don't --- I think we go someplace we
5 don't want to go if we try to over define the specific
6 word disproportionate.

7 BY ATTORNEY TRYON:

8 Q. So it's just not something that you or I could
9 look at and reach any kind of conclusion to tell them
10 what that means sitting here today.

11 Is that right?

12 A. I think if we look at a specific sport, I think
13 that if it was limited to just the two of us we might
14 need more expertise to make a decision.

15 Q. Well, let's say if we talked about the one mile
16 --- running one mile, is that something that we could
17 then determine what disproportionate competitive
18 advantage and performance would mean?

19 ATTORNEY BLOCK: Objection to form.

20 THE WITNESS: It would depend on context.
21 And if we're talking about at the elite level which is
22 what the IOC references and we limited --- even then if
23 we limit it just to you and to myself, we would want
24 more expertise.

1 BY ATTORNEY TRYON:

2 Q. Right. Okay.

3 So we don't know what the IOC meant by this in
4 any particular context do we?

5 ATTORNEY BLOCK: Objection to form.

6 ATTORNEY TRYON: Actually, let me redraw
7 this question.

8 BY ATTORNEY TRYON:

9 Q. You as an expert would not be able to give me an
10 expert opinion on what disproportionate competitive
11 advantage in performance of the one mile run would be;
12 right? You could not give me an expert opinion on that.

13 Fair statement?

14 A. If you break the words out in that --- in that
15 fashion then it does become difficult. If you ask me
16 what the entire statement after the letter A is
17 referencing, I can at least explain some of the thought
18 process for the IOC there.

19 Q. Well, my question is simply, you as an expert,
20 are you able to tell me what --- able to define for me
21 what would be a consistent, unfair disproportionate
22 competitive advantage in performance in a one mile run
23 for the IOC?

24 ATTORNEY BLOCK: Objection to form.

1 THE WITNESS: I, as an expert, cannot
2 give you a blanket explanation of what would
3 specifically consist of --- what would specifically meet
4 that definition. When they wrote the statement they
5 didn't actually even have specific guidance, that is
6 simply the spirit of a guideline --- the spirit of what
7 a specific guideline should consider when that guideline
8 is made.

9 BY ATTORNEY TRYON:

10 Q. Do you know what they meant when they said
11 unfair?

12 A. So the --- it's kind of the same circumstance.
13 That is the purpose of this statement is to be global
14 guidance for the experts in the specific sport when they
15 might develop guidelines relevant to their specific
16 sport. So for example, the group with expertise in that
17 one mile run that you're referencing should think in
18 this context. That's all this is doing.

19 Q. And some of the sporting organizations have come
20 up with some very specific rules.

21 Correct?

22 A. Some of the sporting federations have come up
23 with specific rules, yes.

24 Q. And as I recall, some of them require a certain

1 level of circulating testosterone.

2 Is that right?

3 A. Some of the sporting federations use a certain
4 level of circulating hormone as part or all of their
5 roles.

6 Q. And some of them use the level that you've
7 mentioned that you were involved in setting, which was 5
8 Nmol --- say it for me. Nmol something.

9 A. Nmol/Ls per liter. Yes, some of them use that
10 nmol/L per liter threshold.

11 Q. Did they --- where did they get that 5 nmol/L
12 quantity, do you know?

13 ATTORNEY BLOCK: Objection to form.

14 THE WITNESS: So I do know where that
15 number comes from originally for World Athletics, which
16 is the first one to put that number out. And that
17 number comes from studies of some Olympic athletes in
18 some races where there was for at least certain
19 distances a demonstrable difference between people who
20 had --- and specifically people in the female category
21 who had lower numbers of testosterone than that and
22 higher numbers of testosterone than that.

23 BY ATTORNEY TRYON:

24 Q. You were on that committee.

1 Right?

2 A. I was on the group that wrote that World
3 Athletics policy, yes. Not on the group that did that
4 study.

5 Q. And so how did you finally come up with the
6 number of five as opposed to four or six or three or
7 seven?

8 A. The number five discriminates in terms --- in
9 terms of there being some demonstrated advantage or
10 improved outcome is really what it was, for those with
11 higher numbers versus those with lower numbers. That
12 was not true necessarily with a lower testosterone
13 threshold. That is a difference was not as apparent and
14 that's really the entire logic pattern there.

15 Q. Well, earlier you just said it could have been
16 --- you didn't think there was that much difference
17 between five and six. That was your testimony earlier
18 as I recall.

19 Right?

20 ATTORNEY BLOCK: Objection.

21 THE WITNESS: As an endocrinologist I can
22 tell you that those difference --- that that's right
23 that to --- the difference between five and six would be
24 hard to demonstrate.

1 BY ATTORNEY TRYON:

2 Q. So how did you settle on five instead of six or
3 five or six instead of four?

4 A. So I guess the inputs are that there needed to
5 be a line so that there's ability to enforce something.
6 There needed to be a rule. And the choice of five,
7 mostly, is what I've been saying already, which is ---
8 it's a clean number where there's at least some
9 distances, there's a demonstrable difference in outcomes
10 at that level --- above and below that level.

11 Q. So are you saying that there is a value of
12 having a hard rule?

13 ATTORNEY BLOCK: Objection to form.

14 BY ATTORNEY TRYON:

15 Q. Maybe I should say having a clean rule?

16 A. So as an expert I'm not --- that wasn't my role
17 on the committee to determine that there needed to be a
18 rule, but that is certainly the logic pattern of the
19 committee that there ought to be a rule. That is not my
20 expert opinion.

21 Q. Okay.

22 But different organizations are free to come up
23 with different conclusions of about what their rules
24 ought to be.

1 Right?

2 ATTORNEY BLOCK: Objection to form.

3 THE WITNESS: So the different
4 International Athletic Federations were to make use of
5 data such as it exists to make their own rules for
6 participation in their sports.

7 BY ATTORNEY TRYON:

8 Q. And different organizations came up with very
9 different rules.

10 Right?

11 ATTORNEY BLOCK: Objection to form.

12 THE WITNESS: So most of the
13 international federations still do not have rules,
14 actually. And honestly, that's mostly a logistics
15 situation where some of these organizations are too
16 small to put the data together or the committees
17 together to make rules.

18 BY ATTORNEY TRYON:

19 Q. Those that do have rules have different rules.

20 Correct?

21 A. Those that do have rules have had different
22 conversations in the space. I don't know that I could
23 systematically go through all of them, but there is some
24 variation, yes.

1 Q. Some require --- have a Level 5 nanomoles per
2 liter and some still have ten.

3 Right?

4 A. So I'd have to go back and look. You would have
5 to show me. World Athletics has five for sure. And
6 that's the one where I'm most familiar because I was
7 actually sitting in the room helping draft that. The
8 IOC in the past had used ten as a line, but that just
9 sits there right now as a --- as a number someone might
10 adopt. I actually don't know off the top of my head if
11 anybody has adopted that for their formal rules.

12 Q. What was the scientific basis for the ten
13 nanomoles per liter?

14 A. The logic for ten at the time is it is the
15 bottom of the male range. That's its history.

16 Q. Okay.

17 So it sounds to me like there is room for
18 reasonable discussion about what the appropriate rule
19 ought to be?

20 ATTORNEY BLOCK: Objection to form.

21 THE WITNESS: The way I would say it is
22 as different athletic organizations obtain data, they
23 might use those data to determine differences, including
24 if the --- if our best measure is testosterone,

1 different thresholds of testosterone.

2 BY ATTORNEY TRYON:

3 Q. Would it be appropriate to use performance data
4 as well to make those decisions?

5 A. The best data in my opinion are actual outcomes
6 within a given sport.

7 Q. What do you mean by outcomes, performance? Are
8 we saying the same thing?

9 A. I don't know if we're saying the same thing. So
10 the studies that I reference are the Roberts study and
11 the Harper study, where they actually look at specific
12 athletic endeavors and measure those as opposed to the
13 studies where they're simply sitting in a physiology lab
14 measuring somebody move an arm back and forth and
15 thinking that it might associate with some actual
16 athletic performance.

17 Q. Somebody moving their arm back and forth with
18 weights, that's not athletic?

19 A. It's --- again, it would --- right, that's ---
20 that's only --- that's what we would call a surrogate
21 endpoint where you are simply looking at something that
22 might correlate with what you want, but --- but you
23 don't know it until you test it. It ends up being what
24 we call hypothesis generating. That is how we would say

1 it in a scientific way.

2 Q. And the same would hold true with the level of
3 circulating testosterone, you would want to actually
4 test that in real life to see how people's circulating
5 testosterone actually translates into performance of an
6 actual athletic contest.

7 Right?

8 A. That's right. So the data that were used to
9 determine the five nanomole per liter cut point are
10 passively collected data. And if somebody did a study
11 looking at that threshold and found that there was,
12 let's say, no difference, then that rule might be
13 discarded.

14 Q. And so far, other than Roberts and Harper, if I
15 recall correctly, those are the only two that you know
16 of.

17 Right?

18 ATTORNEY BLOCK: Objection to form.

19 THE WITNESS: Those are the only two
20 studies that have gone that extra step and looked at an
21 actual athletic activity with an outcome that is part of
22 that athletic activity and not what I was just
23 referencing, as a surrogate endpoint.

24 BY ATTORNEY TRYON:

1 Q. In those two studies did they check the
2 circulating testosterone in the individuals in these
3 studies?

4 A. I'd have to look. I think we did look earlier
5 today with regard to the Harper study, and I don't think
6 she's referencing testosterone levels at all. Again,
7 I'd have to go back and look to be sure. We were
8 talking about whether they were self-reported. And the
9 --- with the Robert study I would have to go back and
10 look at that one, too. I'm feeling like the answer is
11 no, but we can look there if you want.

12 Q. Yeah, we don't need to. I'm pretty sure that we
13 just talked about how long they had been in the therapy
14 rather than actual measurements.

15 Well, let me move on. I know we don't have a
16 lot of time left.

17 So you said you're familiar in your expert
18 report you are familiar with HB-3293.

19 Is that right?

20 ATTORNEY BLOCK: Objection to form.

21 THE WITNESS: So yes, I'm somewhat
22 familiar.

23 BY ATTORNEY TRYON:

24 Q. Have you read the whole thing?

1 A. I don't think I've read the whole thing, no.

2 Q. When did you first hear of HB-3293?

3 A. I probably first heard of it when the --- when I
4 received contact from the ACLU to serve as an expert
5 witness.

6 Q. Do you recall if that was before or after it was
7 passed?

8 A. I don't recall. I would have to speculate that
9 it would be after, because that would --- I mean that
10 would make sense that that is true, but I don't recall,
11 so I wouldn't be able to answer that.

12 Q. Okay.

13 So we would refer to this as State Women's
14 Sports Law and there's other types of laws like this
15 throughout the country.

16 Are you aware of that?

17 ATTORNEY BLOCK: Objection to form.

18 THE WITNESS: So I'm aware that there are
19 attempts at legislation and some actual legislation
20 passed to block transgender athletes in various
21 permeations, including transgender women in several
22 states. I'm aware of that, yes.

23 BY ATTORNEY TRYON:

24 Q. Are you aware then House Bill 3293 the word

1 transgender does not appear at all?

2 A. House Bill --- that's this one?

3 Q. That is this one.

4 A. I was not aware that the word transgender does
5 not appear at all.

6 Q. Are you tracking the other bills out there that
7 are similar to House Bill 3293?

8 A. I am not personally tracking the other bills,
9 no.

10 Q. Can you take a look at the Handelsman report
11 that you have in front of you. I don't recall the
12 exhibit number.

13 ATTORNEY WILKINSON: I think Exhibit 13
14 --- oh, sorry, it's Exhibit 4, I think.

15 THE WITNESS: I don't see.

16 ATTORNEY WILKINSON: I can give you that.

17 THE WITNESS: The stack got big.

18 ATTORNEY TRYON: We can just bring it ---
19 if you can't find it we can bring it up on the screen?

20 THE WITNESS: Okay.

21 I was given another copy, so we're good.
22 I have it in front of me.

23 BY ATTORNEY TRYON:

24 Q. Okay.

1 On the second page?

2 A. On the second page.

3 Q. Okay.

4 Under fairness and segregation in sports.

5 Do you see that section?

6 A. I do.

7 Q. In the third full paragraph underneath there ---
8 oh the formatting there is a little different than the
9 copy that I have. Let's see. There's a paragraph that
10 starts the terms sex and gender. There it is. The
11 terms sex and gender are often confused as
12 interchangeable. Now, I want you to focus on this next
13 sentence. Sex is an objective specific biological
14 state, a term with distinct fixed facets notably
15 genetic, chromosomal, gonadal, hormonal and phenotypic
16 including genital sex, each of which has a
17 characteristic defined binary form. Did I read that
18 correctly?

19 A. You read that correctly, yes.

20 Q. Do you agree with that statement?

21 A. I don't agree with that statement completely,
22 no.

23 Q. What specifically do you find objectionable.

24 A. It's missing some components of sex, including,

1 for example gender identity. And the phrasing
2 characteristic defined binary form is not necessarily
3 true for each component of biological sex.

4 Q. So you disagree with the statement in the
5 Handelsman report, is that --- did I state that fairly?

6 A. Right. I would characterize the statement as
7 not exhaustive.

8 ATTORNEY TRYON: Let me ask the court
9 reporter if I have any time.

10 COURT REPORTER: I have six minutes and
11 58 --- six hours and 58 minutes.

12 ATTORNEY TRYON: Well, I guess with my
13 last two minutes I'll just say thank you for your time
14 and I appreciate it. And I don't have any other
15 questions. I don't know if any of the other Defendants
16 do. I doubt it. But go ahead. If they do, go ahead.
17 Kelly?

18 ATTORNEY MORGAN: This is Kelly Morgan.
19 I don't have any questions. Thank you so much.

20 ATTORNEY TRYON: Roberta? Susan, you're
21 next.

22 ATTORNEY GREEN: This is Roberta Green on
23 the behalf of the SSAC. No questions. Thank you.

24 ATTORNEY DENIKER: Dr. Safer, this is

1 Susan Deniker. I have no questions. Thank you for your
2 time today.

3 ATTORNEY TRYON: We are finished.

4 VIDEOGRAPHER: This concludes this
5 deposition. The current time reads 6:31 p.m. Eastern
6 Standard Time.

7 * * * * *

8 VIDEOTAPED DEPOSITION CONCLUDED AT 6:31 P.M.

9 * * * * *

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1 STATE OF WEST VIRGINIA)

2 CERTIFICATE

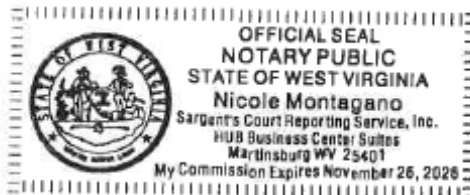
3 I, Nicole Montagano, a Notary Public in
4 and for the State of West Virginia, do hereby
5 certify:

6 That the witness whose testimony appears
7 in the foregoing deposition, was duly sworn by me
8 on said date, and that the transcribed deposition
9 of said witness is a true record of the testimony
10 given by said witness;

11 That the proceeding is herein recorded
12 fully and accurately;

13 That I am neither attorney nor counsel
14 for, nor related to any of the parties to the
15 action in which these depositions were taken, and
16 further that I am not a relative of any attorney
17 or counsel employed by the parties hereto, or
18 financially interested in this action.

19 I certify that the attached transcript
20 meets the requirements set forth within article
21 twenty-seven, chapter forty-seven of the West
22 Virginia.



Nicole Montagano
Nicole Montagano,
Court Reporter

Exhibit

4

Circulating Testosterone as the Hormonal Basis of Sex Differences in Athletic Performance

David J. Handelsman,^{1,2} Angelica L. Hirschberg,^{3,4} and Stephane Bermon^{5,6}

¹ANZAC Research Institute, University of Sydney, Concord, New South Wales 2139, Australia; ²Department of Andrology, Concord Hospital, Sydney, New South Wales 2139, Australia; ³Department of Women's and Children's Health, Karolinska Institutet, 171 76 Stockholm, Sweden; ⁴Department of Gynecology and Reproductive Medicine, Karolinska University Hospital, 171 76 Stockholm, Sweden; ⁵Laboratoire Motricité Humaine, Education, Sport, Santé, Université Côte d'Azur, 06000 Nice, France; and ⁶Health and Science Department, International Association of Athletics Federations, 98000 Monaco

ABSTRACT Elite athletic competitions have separate male and female events due to men's physical advantages in strength, speed, and endurance so that a protected female category with objective entry criteria is required. Prior to puberty, there is no sex difference in circulating testosterone concentrations or athletic performance, but from puberty onward a clear sex difference in athletic performance emerges as circulating testosterone concentrations rise in men because testes produce 30 times more testosterone than before puberty with circulating testosterone exceeding 15-fold that of women at any age. There is a wide sex difference in circulating testosterone concentrations and a reproducible dose-response relationship between circulating testosterone and muscle mass and strength as well as circulating hemoglobin in both men and women. These dichotomies largely account for the sex differences in muscle mass and strength and circulating hemoglobin levels that result in at least an 8% to 12% ergogenic advantage in men. Suppression of elevated circulating testosterone of hyperandrogenic athletes results in negative effects on performance, which are reversed when suppression ceases. Based on the nonoverlapping, bimodal distribution of circulating testosterone concentration (measured by liquid chromatography–mass spectrometry)—and making an allowance for women with mild hyperandrogenism, notably women with polycystic ovary syndrome (who are overrepresented in elite athletics)—the appropriate eligibility criterion for female athletic events should be a circulating testosterone of <5.0 nmol/L. This would include all women other than those with untreated hyperandrogenic disorders of sexual development and noncompliant male-to-female transgender as well as testosterone-treated female-to-male transgender or androgen dopers. (*Endocrine Reviews* 39: 803 – 829, 2018)

Virtually all elite sports are segregated into male and female competitions. The main justification is to allow women a chance to win, as women have major disadvantages against men who are, on average, taller, stronger, and faster and have greater endurance due to their larger, stronger muscles and bones as well as a higher circulating hemoglobin level. Hence, elite female competition forms a protected category with entry that must be restricted by an objective eligibility criterion related, by necessity, to the relevant sex-specific physical advantages. The practical need to establish an eligibility criterion for elite female athletic competition led the International Association of Athletic Federations (IAAF) to establish a rule in 2011, endorsed by the International Olympic Committee (IOC) in 2012, for hyperandrogenic women. That

IAAF regulation stated that for athletes to be eligible to compete in female events, the athlete must be legally recognized as a female and, unless she has complete androgen insensitivity, maintain serum testosterone <10 nmol/L. That IAAF eligibility rule was challenged by an athlete to the Court for Arbitration in Sports, which ruled in 2015 that, although an eligibility criterion was justified, there was insufficient evidence of the extent of the competitive advantage enjoyed by hyperandrogenic athletes who had circulating testosterone >10 nmol/L over female athletes with circulating testosterone in the normal female range. The Court for Arbitration in Sports suspended the rule pending receipt of such evidence. In that context, the present review presents the available evidence on the hormonal basis for the sex difference

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ESSENTIAL POINTS

- It is widely accepted that elite athletic competitions should have separate male and female events
- The main justification is that men's physical advantages in strength, speed, and endurance mean that a protected female category, with objective entry criteria, is required
- Prior to puberty, there is no sex difference in circulating testosterone concentrations and athletic performance
- From male puberty onward, the sex difference in athletic performance emerges as circulating testosterone concentrations rise as the testes produce 30 times more testosterone than before puberty, resulting in men having 15- to 20-fold greater circulating testosterone than children or women at any age
- This wide, bimodal sex difference in circulating testosterone concentrations and the clear dose-response relationships between circulating testosterone and muscle mass and strength, as well as the hemoglobin level, largely account for the sex differences in athletic performance
- Based on the nonoverlapping, bimodal distribution of circulating testosterone concentration (measured by liquid chromatography–mass spectrometry) with 95% reference ranges of 7.7 to 29.4 nmol/L in healthy men and 0 to 1.7 nmol/L in healthy premenopausal women—making an allowance for women with the mild hyperandrogenism of polycystic ovary syndrome, who are overrepresented in elite athletics—the eligibility criterion for female athletic events should be a circulating testosterone concentration of <5.0 nmol/L

in athletic performance. It concludes that the evidence justifies a revised eligibility criterion of a threshold

circulating testosterone concentration of 5 nmol/L (measured by a mass spectrometry method).

Sex, Fairness, and Segregation in Sport

If sports are defined as the organized playing of competitive games according to rules (1), fixed rules are fundamental in representing the boundaries of fair sporting competition. Rule breaking, whether by breaching eligibility or competition rules, such as use of banned drugs, illegal equipment, or match fixing, creates unfair competitive advantages that violate fair play. Cheating constitutes a fraud against not just competitors but also spectators, sponsors, the sport, and the public. In the absence of genuine fair competition, elite sports would lose their wide popular appeal and ability to captivate and inspire with the authentic attraction of genuine contest between highly trained athletes.

Nevertheless, fairness is an elusive, subjective concept with malleable boundaries that may change over time as social concepts of fairness evolve. For example, until the late 19th century when organized sports trainers emerged, training itself was considered a breach of fairness because competition was envisaged at that time as a contest based solely on natural endowments. Similarly, sports once distinguished between amateurs and professionals. The concept of fairness has deep and complex philosophical roots mainly focused on notions of distributive justice. These considerations affect sports through the universal application of antidiscrimination and human rights legislation. Less attention is given to the philosophical basis of fair competition in elite sports, where the objectives are not egalitarian but aim to discover a hierarchy of achievement derived

from a mixture of unequal natural talent and individual training effort. Excellent, insightful discussion of the legal and moral complexities of sex and fair competition in elite sports from a legal scholar and former elite female athlete is available (2).

The terms *sex* and *gender* are often confused and used as if interchangeable. *Sex* is an objective, specific biological state, a term with distinct, fixed facets, notably genetic, chromosomal, gonadal, hormonal, and phenotypic (including genital) sex, each of which has a characteristic defined binary form. Whereas all facets of biological sex are almost always aligned so that assignment of sex at birth is straightforward, rare instances in which two or more facets of biological sex conflict constitute an intersex state, now referred to as disorders (or differences) of sex development (DSDs) (3). In contrast, *gender* is a subjective, malleable, self-identified social construct that defines a person's individual gender role and orientation. Prompted by biological, personal, and societal factors, volitional expression of gender can take on virtually any form limited only by the imagination, with some individuals asserting they have not just a single natal gender but two genders, none, a distinct third gender, or gender that varies (fluidly) from time to time. Hence, whereas gender is usually consistent with biological sex as assigned at birth, in a few it can differ during life. For example, if gender were the basis for eligibility for female sports, an athlete could conceivably be eligible to compete at the same Olympics in both female and male events. These features render the unassailable personal assertion of gender identity incapable of forming a fair, consistent sex classification in elite sports.

The strongest justification for sex classification in elite sports is that after puberty men produce 20 times more testosterone than women (4–7), resulting in circulating testosterone concentrations 15-fold higher than in children or women of any age. Age-grade competitive sporting records show no sex differences prior to puberty, whereas from the age of male puberty onward there is a strong and ongoing male advantage (8). The striking male postpubertal increase in circulating testosterone provides a major, ongoing, cumulative, and durable physical advantage in sporting contests by creating larger and stronger bones, greater muscle mass and strength, and higher circulating hemoglobin as well as possible psychological (behavioral) differences. In concert, these render women, on average, unable to compete effectively against men in power-based or endurance-based sports.

Sex classification in sports therefore requires proof of eligibility to compete in the protected (female) category. This deceptively simple requirement for fairness is taken for granted by peer female competitors who regard participation by males, or athletes with physical features closely resembling males, as unfair. This makes policing of eligibility inescapable for sports, to avoid unfair male participation in female events. However, such policing inevitably intrudes into highly personal matters so that it must be achieved with respect for dignity and privacy, demanding use of the least invasive, scientifically reliable means. Unsurprisingly, this dilemma has always been highly contentious since it first entered international elite sports in the early 20th century, and it has become increasingly prominent and contentious in recent decades; nevertheless, the requirement to maintain fair play in female events will not disappear as long as separate female competitions exist. During recent decades, there has been progressively better understanding of the complex biology of genetic sex determination and the impact of pubertal sexual maturation in establishing phenotypic sexual dichotomy in physical capabilities. These sex-dichotomous physical features form the basis of, but remain quite distinct from, adult gender roles and identity. During the last century, as knowledge grew, the attempts to formalize a scientific basis for the unavoidable necessity of policing eligibility for the female category have been continually challenged. Most recently, the increasing assertion of gender self-identification as a social criterion has further challenged the hegemony of biology for determining “sports sex,” Coleman’s apt term (2). Allowing subjective gender self-identification to become the sole criterion of sports sex would allow for gaming and perceptions of systematic unfairness to grow. The case for women’s sports being defined by sex rather than gender, including the consequences of acceding to gender-based classification, has been outlined (9) in arguing the importance of proper medical

management of athletes intending to compete in female events.

Separate male and female events in sports is a dominant form of classification that is superimposed on other graduated age group and weight classifications (e.g., in weightlifting, power lifting, wrestling, boxing, rowing), which reflect differences in strength, power, and speed to ensure fairness in terms of opportunity to win and, additionally, safety in contact sports. Age and weight classifications rely on objective criteria (birth date, weigh-in weight) for eligibility, and so should sex classification. Nevertheless, some power sports dependent on explosive strength and power (e.g., throwing events, sprinting) do not segregate weight classes, whereas other sports where height is an advantage (e.g., basketball, jockeys) do not have height classifications. These sports disproportionately attract athletes with greater weight and/or power-to-weight ratio or advantageous stature, respectively. If sex classification were eliminated, such open or mixed competitions would be dominated almost exclusively by men. It therefore seems highly unlikely that sex classification would ever be discarded, despite calls on philosophical or sociological grounds to end “gender” classification in sport (10).

Sex Difference in Circulating Testosterone Levels

Testosterone biosynthesis, secretion, and regulation in men and women

An androgen is a hormone capable of developing and maintaining masculine characteristics in reproductive tissues (notably the genital tract, as well as in other tissues and organs associated with secondary sexual characteristics and fertility) and contributing to the anabolic status of nonreproductive body tissues (11). The two dominant bioactive androgens circulating in mature mammals, including humans—testosterone and its more potent metabolite DHT—account for the development and maintenance of all androgen-dependent characteristics, and their circulating levels in men and nonpregnant women arise from steroids synthesized *de novo* in the testes, ovary, or adrenals (12).

The sexually undifferentiated gonads in the embryo develop into either ovaries or testes according to whether a Y chromosome (or at least the *sry* gene) is present. After birth and until puberty commences, circulating testosterone concentrations are essentially the same in boys and girls, other than briefly in the neonatal period of boys when higher levels prevail. The onset of male puberty, a brain-driven process triggered by a still mysterious hypothalamic or higher cerebral mechanism (13), initiates a hormonal cascade. In males, this leads to enhanced pituitary LH secretion that stimulates the 500 million Leydig cells in the testes

to secrete 3 to 10 mg (mean, 7 mg) of testosterone daily (4, 6, 7, 14, 15). This creates a very high local concentration of testosterone within the testis as well as a steep downhill concentration gradient into the bloodstream that maintains circulating testosterone levels at adult male levels, which are tightly regulated by strong negative hypothalamic feedback of circulating testosterone. In the absence of testes, these mechanisms do not function in females. In girls, serum testosterone increases during puberty (16), peaking at age 20 to 25 years before declining gradually with age (17, 18), but it remains <2 nmol/L at all ages, as determined by a reliable method (see below).

In adult women, circulating testosterone is derived from three roughly equal sources: direct secretion from the adrenal gland or the ovary and indirect extraglandular conversion (in liver, kidney, muscle, fat, skin) from testosterone precursors secreted by the adrenal and ovary. Only when circulating testosterone concentrations rise in male adolescents above the prepubertal concentrations does the virilization characteristic of men commence, progress, and endure throughout adult life, at least until old age (18). In combination, these different sources produce ~ 0.25 mg of testosterone daily so that throughout life women maintain circulating testosterone levels of <2 nmol/L. Circulating testosterone concentrations in women are subject to little dynamic physiological regulation. As a result, circulating testosterone concentrations in healthy premenopausal women are stable (nonfluctuating) and not subject to strong negative feedback by exogenous testosterone (as happens in men). Even the small rise (50%) at the time of the mid-cycle LH surge triggering ovulation (19) remains within the physiological range for premenopausal females.

Male and female reference ranges for circulating testosterone

A reliable threshold for circulating testosterone must be set using measurement by the reference method of liquid chromatography–mass spectrometry (LC-MS) rather than using one of the various available commercial testosterone immunoassays. The necessary reliance on steroid mass spectrometry for clinical applications in endocrinology, reproductive medicine, and sports medicine is widely recognized. It has been standard for decades in antidoping science (20), and the growing consensus is that it is required for high-quality clinical research and practice recognized by cognate professional societies (21, 22) and editorials in leading clinical endocrinology (23) and reproductive medicine (24) journals. The inherently limited specificity of testosterone immunoassays arises from antibody cross-reactivity with structurally related steroids (such as precursors and metabolites) other than the intended target. As a result, all steroid immunoassays, including for testosterone, display method-specific bias whereby, for example, the lower limit of a

testosterone reference range in healthy young men varies from 7.3 to 12.6 nmol/L according to the immunoassay used, so that no consensus definition of a lower limit could be obtained independent of the commercial immunoassay method used (25). Furthermore, testosterone immunoassays are optimized for circulating levels in men but display increasing inaccuracy at the lower, by an order of magnitude, circulating testosterone concentrations in women or children. In contrast to immunoassays, LC-MS–based methods are highly specific and do not depend on proprietary antibodies. Using LC-MS–based measurements, method-specific bias can be avoided and a fixed consensus lower reference limit defined (Table 1). Hence, for the precision required in sports medicine, whether for eligibility criteria or antidoping applications, testosterone in serum must be measured by LC-MS methods.

Prior to puberty, levels of circulating testosterone as determined by LC-MS are the same in boys and girls (16). They remain lower than 2 nmol/L in women of all ages. However, from the onset of male puberty the testes secrete 20 times more testosterone resulting in circulating testosterone levels that are 15 times greater in healthy young men than in age-similar women. Using LC-MS measurement, circulating testosterone in adults has a strikingly nonoverlapping bimodal distribution with wide and complete separation between men and women. Table 1 (25–36) summarizes data from appropriate reported studies using mass spectrometry–based methods to measure serum testosterone in healthy men and women. Based on a number-weighted pooling with conventional 95% two-sided confidence limits of the eight available studies using LC-MS measurements of serum testosterone, the reference range for healthy young men (18 to 40 years) is 7.7 nmol/L to 29.4 nmol/L. Similarly, summarizing the nine available studies for healthy menstruating women under 40 years, the 95% (two-sided) reference range is 0 to 1.7 nmol/L. These reference limits do not control for factors such as oral contraceptive use (35, 36), menstrual phase (19), SHBG (37, 38), overweight (39, 40), fasting and smoking (41), diet (40), and physical activity (42, 43) in women and men, all of which have small effects on circulating testosterone but without materially influencing the divergence between the nonoverlapping bimodal distribution of male and female reference ranges of circulating testosterone.

In creating a threshold for eligibility for female events it is also necessary to make allowance for women with polycystic ovary syndrome (PCOS) and nonclassical adrenal hyperplasia. PCOS is a relatively common disorder among women of reproductive ages with a prevalence of 6% to 10%, depending on the diagnostic criteria used (44), in which mild hyperandrogenism is a key clinical feature and has higher than expected prevalence among elite female athletes

Table 1. Serum Testosterone Measurements by LC-MS Methods in Studies of Healthy Men and Women

Study	Sample (Age 18–40 y)	N	Lower 95% CL (nmol/L)	Upper 95% CL (nmol/L)
Men				
Sikaris <i>et al.</i> , 2005 (25)	Elite, eugonadal	124	10.4	30.1
Turpeinen <i>et al.</i> , 2008 (26)	Convenience	30	10.1	31.2
Kushnir <i>et al.</i> , 2010 (27)	Convenience	132	7.2	24.2
Salameh <i>et al.</i> , 2010 (28)	Convenience	264	7.1	39.0
Neale <i>et al.</i> , 2013 (29)	Convenience	67	10.6	31.9
Kelsey <i>et al.</i> , 2014 (30)	Secondary pooled analysis	1058	7.2	25.3
Hart <i>et al.</i> , 2015 (31)	Birth cohort	423	7.4	28.0
Travison <i>et al.</i> , 2017 (32)	Pooled two cohorts	1656	7.9	31.1
Number-weighted mean			7.7	29.4
Women				
Turpeinen <i>et al.</i> , 2008 (26)	Convenience	32	0.8	2.8
Kushnir <i>et al.</i> , 2010 (27)	Convenience	104	0.3	2.0
Salameh <i>et al.</i> , 2010 (28)	Convenience	235	0.03	1.5
Haring <i>et al.</i> , 2012 (33)	Population-based	263	0.04	2.0
Neale <i>et al.</i> , 2013 (29)	Convenience	90	0	1.7
Bui <i>et al.</i> , 2013 (34)	Convenience	25	0.30	1.69
Rothman <i>et al.</i> , 2013 (19)	Convenience	31	0.4	0.92
Bermon and Garnier, 2017 (35)	Elite athletes	1652	0	1.62
Eklund <i>et al.</i> , 2017 (36)	Elite athletes and controls	223	0.26	1.73
Number-weighted mean			0.06	1.68

Abbreviation: CL, confidence limit.

(36, 45–47). Nonclassical adrenal hyperplasia is a milder and later (adult) onset variant of classical congenital adrenal hyperplasia (48) with a much higher but still rare population prevalence (1:1000 vs 1:16,000 for the classical variant) (49). Table 2 (50–64) summarizes clinical studies ($n = 16, \geq 40$ women) reporting serum testosterone concentrations measured by LC-MS in samples from women with PCOS.

The pooled data reveal that the upper limit of serum testosterone in women with PCOS is 3.1 nmol/L (95% CI, one-sided) or 4.8 nmol/L (using a 99.99% CI, one-sided) (Table 3). Hence, a conservative threshold for circulating testosterone of 5 nmol/L measured by LC-MS would identify $<1:10,000$ women with PCOS as false positives, based on circulating testosterone measurement alone. Circulating testosterone higher than this threshold is likely to be due to testosterone-secreting adrenal or ovarian tumors, intersex/DSD, badly controlled or noncompliant male-to-female (M2F) transgender athletes, or testosterone doping.

The physiological effects of testosterone depend on the circulating testosterone, not its source (endogenous or exogenous)

Testosterone, whether of a natural endogenous or manufactured exogenous source, has an identical chemical structure and biological effects, aside from minor differences in isotopic composition, which are biologically insignificant. At equivalent doses and circulating levels, exogenous testosterone exerts the same biological and clinical effects on every known androgen-responsive tissue or organ as endogenous testosterone, apart from effects on spermatogenesis, which as discussed below is only a matter of degree. Consequently, exogenous testosterone is a fully effective substitute for endogenous testosterone in therapeutic use, countering the effects of testosterone deficiency due to hypogonadism (reproductive system disorders). Any purported differences between endogenous and exogenous testosterone are due to corresponding differences in the endogenous production rate or exogenous dose. Such differences in

Data taken directly from paper or interpolated from other data (e.g., median, quartiles, ranges, sample size) supplied as described by Wan *et al.*, 2014 (Estimating the sample mean and standard deviation from the sample size, median, range and/or interquartile range. BMC Med Res Methodol 14: 135) are shown in italics.

Table 2. Summary of Serum Testosterone (nmol/L) by LC-MS in Women With PCOS From 16 Studies

Study	N	Mean	SD
Moran <i>et al.</i> , 2017 (50)	92	0.24	0.08
Münzker <i>et al.</i> , 2017 (51)	274	0.93	0.19
O'Reilly <i>et al.</i> , 2017 (52)	114	0.55	0.19
Handelsman <i>et al.</i> , 2017 (53)	152	0.38	0.25
Pasquali <i>et al.</i> , 2016 (54)	156	1.17	0.47
Yang <i>et al.</i> , 2016 (55)	1159	2.2	1.44
Tosi <i>et al.</i> , 2016 (56)	116	1.33	0.55
Daan <i>et al.</i> , 2015 (57)	170	1.64	0.53
Bui <i>et al.</i> , 2015 (58)	44	0.85	0.3
Keefe <i>et al.</i> , 2014 (59)	52	1.7	0.97
Yasmin <i>et al.</i> , 2013 (60)	165	1.99	1.02
Janse <i>et al.</i> , 2011 (61)	200	1.12	0.47
Jedel <i>et al.</i> , 2011 (62)	72	0.23	0.08
Legro <i>et al.</i> , 2010 (Mayo) (63)	596	2.12	0.89
Legro <i>et al.</i> , 2010 (Quest) (63)	596	1.98	0.97
Stener-Victorin <i>et al.</i> , 2010 (64)	74	1.53	0.62
Sum	4032		
Number-weighted mean		1.69	0.87

effective exposure lead to corresponding differences in circulating testosterone levels and its effects according to the dose-response curves for testosterone.

Similar to all hormones and drugs, over their effective range of biological activity the dose-response relationship for testosterone is usually a sigmoidal curve with lower and upper plateaus joined by a monotonically rising middle region, which may be linear in the natural scale but more often log-linear (linear on the log or similar transformed scale). In the middle portion of the typical sigmoidal dose-response curve for the same increase in testosterone dose (or concentration), the response would be increased in simple proportional (*i.e.*, linear) but more often on a logarithmic scale. In contrast, at the lower and upper plateaus of dose or concentrations, changes in testosterone exposure may evoke minimal or no response on the endpoint. For example, in women of any age circulating testosterone concentrations are along the lower plateau of the dose-response curve, so that increases in circulating testosterone concentrations within that lower plateau may have minimal or no effect. In female athletes with the mild hyperandrogenism of PCOS, higher performance has been shown (47), with their muscle mass and power performance correlating with androgen levels (36).

However, beyond these effects where endogenous testosterone concentrations are in the high-normal adult female range, it is only when the increases in circulating testosterone concentrations substantially and consistently exceed those prevailing in childhood (<2 nmol/L) and among women including those with PCOS (<5 nmol/L) that the effects would replicate the effects of rising testosterone concentrations of boys in middle to late puberty (typically >8 nmol/L), that is, the masculinizing effects of increased muscle, bone, and hemoglobin characteristics of men. As shown above, the circulating testosterone of most women never reaches consistently >5 nmol/L, a level that boys must sustain for some time to exhibit the masculinizing effects of male puberty.

In addition, the effects of testosterone are modulated in a form of fine tuning by the patterns of exposure, such as whether the circulating testosterone is delivered in the unphysiological steady-state format (*e.g.*, quasi-steady-state delivery by implant or transdermal products) or by the peak-and-trough delivery of injections, as opposed to the natural state of endogenous fluctuations in serum testosterone around the average adult male levels. However, these latter pattern effects are subtle and the dominant effect remains that of dose and average testosterone

concentrations in blood, however they arise. Furthermore, there is evidence that the androgen sensitivity of responsive tissues differs and may be optimal at different circulating testosterone concentrations (65).

Male sexual function is maintained by endogenous testosterone at adult male circulating concentrations. These effects can be replicated by exogenous testosterone if and only if it achieves comparable circulating testosterone concentrations. For example, in a well-controlled prospective study of older men with prostate cancer (66), androgen deprivation achieving castrate levels of circulating testosterone sustained during 12 months markedly suppressed sexual desire and function, whereas those effects did not occur in age-matched men having nonhormonal treatment of prostate cancer or those without prostate cancer. In healthy younger men whose endogenous testosterone was fully suppressed, sexual function completely recovered when circulating testosterone was restored to the physiological male range by administration of exogenous testosterone (67). Similar effects were also observed in healthy, middle-aged men in whom male sexual function was fully maintained (compared with placebo) during 2 years of treatment with an exogenous androgen (DHT) despite that treatment causing sustained, complete suppression of endogenous testosterone (68). This further supports the key interpretation that the biological effects of exogenous or endogenous testosterone are the same at comparable circulating levels.

Clinically, exogenous testosterone replicates fully all effects of endogenous testosterone on every reproductive and nonreproductive organ or tissue, with the sole exception of the testis. Sperm production in the testis requires a very high concentration of testosterone (typically 100-fold greater than in the general bloodstream), which is produced in nature only by the action of the pituitary hormone LH. LH stimulates the Leydig cells in the interstitial space of the testis between seminiferous tubules to produce high intratesticular concentrations of testosterone, which are necessary and sufficient to initiate and maintain sperm production in the adjacent seminiferous tubules. This

high concentration of testosterone also provides a downhill gradient to supply the rest of the body, where circulating testosterone acts on androgen-responsive tissues to produce and maintain masculine patterns of androgenization. When exogenous testosterone (or any other androgen) is administered to men, pituitary LH is suppressed by negative feedback and the sperm production halts for as long as exogenous testosterone or androgen exposure continues, after which it recovers (69). However, even the reduction in spermatogenesis and testis size when men are treated with exogenous testosterone is only a matter of degree. It is well established in rodents (70, 71) that spermatogenesis is induced by exogenous testosterone when the testosterone concentrations in the testis are high enough to replicate what occurs naturally via LH stimulation (72). However, direct replication that high-dose testosterone also initiates and maintains spermatogenesis in humans is not feasible, as these testosterone doses are 10- to 100-fold higher than could be safely given to humans. Nevertheless, confirmatory evidence in humans is available from rare cases of men with an activating mutation of the chorionic gonadotropin/LH receptor (73, 74). This mutation causes autonomous testicular testosterone secretion leading to precocious puberty arising from the premature adult male circulating testosterone concentrations that lead to complete suppression of circulating gonadotropin (LH, FSH) secretion. In this illustrative case the testis was exposed to non-physiologically high testosterone concentrations (but without any gonadotropin stimulation) that induced sperm production and allowed for natural paternity (73). This indicates that even for spermatogenesis, exogenous testosterone can replicate all biological effects of endogenous testosterone in accordance with the relevant dose-response characteristics.

The most realistic view is that increasing circulating testosterone from the childhood or female range to the adult male range will have the same physiological effects whether the source of the additional testosterone is endogenous or exogenous. This is strongly supported by well-established knowledge about the relationship of circulating testosterone concentrations

Table 3. Upper Confidence Limits on Serum Testosterone in Women With PCOS

Confidence Interval	Likelihood ^a	SD ^b	One-Sided ^c	Two-Sided ^c
95%	1:20	1.96	3.13	3.39
99%	1:100	2.35	3.47	3.73
99.9%	1:1000	3.10	4.21	4.39
99.99%	1:10,000	3.72	4.77	4.95

^aLikelihood that a woman with PCOS would exceed that limit by chance.

^bNumber of SDs for each confidence limit.

^cTwo-sided CIs are conventional for a result that could exceed or fall below confidence limits, but here we focus only on values exceeding the upper limit, so that one-sided confidence limits are appropriate.

with the timing and manifestations of male puberty. The characteristic clinical features of masculinization (e.g., muscle growth, increased height, increased hemoglobin, body hair distribution, voice change) appear only if and when circulating testosterone concentrations rise into the range of males at mid-puberty, which are higher than in women at any age even after the rise in circulating testosterone in female puberty. If and only if the pubertal rise in circulating testosterone fails will the males affected be clinically considered hypogonadal. Such a failure of male puberty may occur for genetic reasons (arising from mutations that inactivate any of the cascade of proteins whose activity is critical in the hypothalamus to trigger male puberty) or as a result of acquired conditions, caused by pathological disorders of the hypothalamus or pituitary or functional defects arising from severe deficits of energy or nutrition (e.g., extreme overtraining, undernutrition), with the latter being comparable with hypothalamic amenorrhea or anorexia nervosa in female athletes/ballet dancers. If male puberty fails, testosterone replacement therapy is fully effective in replicating all of the distinctive masculine features apart from spermatogenesis.

Elevated circulating testosterone concentration caused by DSDs

Rare genetic intersex conditions known as DSDs can lead to markedly increased circulating testosterone in women. When coupled with ambiguous genitalia at birth, they may appear as undervirilized males or virilized females. This can cause athletes who were raised and identify as women to have circulating testosterone levels comparable to those of men and greatly exceeding those of non-DSD (and nondoped) women, including those with PCOS. Key congenital disorders in this category are 46,XY DSDs, namely 5 α reductase deficiency (75), 17 β -hydroxysteroid dehydrogenase type 3 deficiency (76), and androgen insensitivity (77, 78), as well as congenital adrenal hyperplasia (79), which is a 46,XX DSD. There is evidence that the first three conditions, components of 46,XY DSDs, are 140-fold more prevalent among elite female athletes than expected in the general population (80).

Genetic 5 α reductase deficiency is due to an inactivating mutation in the 5 α reductase type II enzyme (75). This leads to a deficit of DHT during fetal life when DHT is required for converting the sex-undifferentiated embryonic and fetal tissue to form the sex-differentiated masculine form external genitalia. Although genetic males (46,XY) with 5 α reductase deficiency will develop testes, they usually remain undescended and labial fusion to form a scrotum and phallic growth does not occur. Hence, at birth the external genitalia may appear feminine, leading to a female assigned natal sex. Thus, individuals with 5 α reductase deficiency may have male chromosomal sex

(46,XY), gonadal sex (testes), and hormonal sex (adult male testosterone concentrations), but such severely undervirilized genitalia that affected individuals may be raised from birth as females rather than as undervirilized males. However, from the onset of male puberty, testicular Leydig cells start producing large amounts of testosterone, and the steep rise in circulating testosterone to adult male levels (with the permissive role of 5 α reductase activity) leads to masculine virilization, including male patterns of muscle and bone growth, hemoglobin levels, and other masculine body habitus features (hair growth pattern, voice change), as well as phallic growth (80). Such changes of male puberty prompt around half affected individuals who had female sex assigned at birth and developed as girls prior to puberty to adopt a male gender identity and role at puberty (81). Sperm are formed in the testes so that, using *in vitro* fertilization, these individuals may father children (82).

17 β -Hydroxysteroid dehydrogenase type 3 deficiency (76) has a natural history similar to that of 5 α reductase deficiency. This disorder is due to inactivating mutations in a steroidogenic enzyme expressed only in the testis and that is essential for testosterone formation in the fetus. In the absence of a functional enzyme, the testis makes little testosterone but instead secretes large amounts of androstenedione, the steroid immediately prior to the enzymatic block. In the circulation, the excess of androstenedione is converted to testosterone (mainly by the enzyme AKR1C3) (12). Although the circulating testosterone is then converted to circulating DHT, insufficient DHT is formed locally within the urogenital sinus to virilize genitalia at birth. This causes the same severe undervirilization of the external genitalia of genetically male individuals, leading to ambiguous genitalia at birth despite male chromosomal, gonadal, and hormonal sex. When puberty arrives, the testes start producing the adult male testosterone output. Again, this leads to marked virilization and subsequent assumption of a male gender identity by some affected individuals, conflicting with a female assigned natal sex and childhood upbringing.

Androgen insensitivity, which arises from mutation in the androgen receptor (AR), poses different but complex challenges for eligibility for female athletic events. As the AR is located on the X chromosome, genetic males (46,XY) are hemizygous, so that an inactivating mutation in the AR can be partially or fully insensitive to androgen action. Affected individuals have male internal genitalia (testes in the inguinal canal or abdomen with Wolffian ducts) and consequently adult male circulating testosterone concentrations after puberty. These nonlethal mutations have a wide spectrum of functional effects, ranging from full resistance to all androgen action in complete androgen insensitivity syndrome (CAIS) where individuals have a full female phenotype with

normal female external genitalia, to partial androgen insensitivity syndrome (PAIS) where some androgen action is still exerted, leading to various degrees of ambiguous genitalia, or to mild androgen insensitivity, which produces a very mild, undervirilized male phenotype (normal male genital and somatic development but with little body hair and no male pattern balding) (77). Testosterone (and dihydrotestosterone) have no consistent effect of inducing normal nitrogen retention (anabolic) responses in patients with CAIS (83–86), although some reduced androgen responsiveness is retained by patients with PAIS (84, 87–90). Athletes with CAIS can compete fairly as females because the circulating testosterone, although at adult male levels, has no physiological effect so that, in terms of androgen action and the ensuing physical somatic advantages of male sex, affected individuals are indistinguishable from females and gain no benefits of the sex difference arising from unimpeded testosterone action. A more complex issue arises with athletes having PAIS reflecting the degree of incomplete impairment of AR function. Residual androgen action in such AR mutations is harder to characterize quantitatively, as there is no standardized, objective *in vitro* test to quantify AR functionality. Hence, individuals with PAIS may have adult male circulating testosterone concentrations but variable androgen sensitivity. At present, determination of eligibility to compete in the female category requires a case-by-case evaluation, primarily based on the degree of virilization. The current best available clinical approach to determining the functional impact (degree of functionality/sensitivity) of an AR mutation is based on the degree of somatic, primarily genital, virilization assessed according to the Quigley classification of grade of androgen sensitivity (91).

Congenital adrenal hyperplasia (CAH) is a relatively common defect in adrenal steroidogenesis in the enzymatic pathway, leading to synthesis of cortisol, aldosterone, and sex steroid precursors. The disease varies in severity from life-threatening (adrenal failure) to mild (hirsutism and menstrual irregularity), or even asymptomatic and undiagnosed. The most common mutations causing CAH occur in the 21-hydroxylase enzyme, accounting for 95% of cases (79). The defect leads to a bottleneck, creating a major backing up of precursor steroids that then overflow into other steroid pathways, leading to diagnostic high levels of 17-hydroxyprogesterone and, in female patients, excessive circulating testosterone or other adrenal-source androgen precursors (e.g., androstenedione, dehydroepiandrosterone) that may be converted to testosterone in tissues. A common clinical problem with management of CAH is that glucocorticoid/mineralocorticoid treatment is not always fully effective partly due to variable compliance, which may leave high circulating testosterone, including well into or even above the normal male range (92). It is unlikely

that mild nonclassical congenital adrenal hyperplasia is a major contributor to the mild hyperandrogenism prevalent among elite female athletes. The prevalence of PCOS (6% to 16%) is about 100-fold higher than mild nonclassical congenital adrenal hyperplasia (0.1%) (49), whereas a disproportionately high number of elite female athletes (especially in power sports) have PCOS (45). In one study of hyperandrogenic female athletes, even mild nonclassical adrenal hyperplasia was ruled out by normal 17-hydroxyprogesterone (36) and, in another (47), reported serum androstenedione and cortisol did not differ from controls, ruling out significant congenital adrenal hyperplasia.

Sex Difference in Muscle, Hemoglobin, Bone, and Athletic Performance Relating to Adult Circulating Testosterone Concentrations

Following puberty, testosterone production increases (16) but remains <2 nmol/L in women, whereas in men testosterone production increases 20-fold (from 0.3 mg/d to 7 mg/d), leading to 15-fold higher circulating testosterone concentrations (15 vs 1 nmol/L). The greater magnitude of sex difference in testosterone production (20-fold) compared with circulating levels (15-fold) is due to women's higher circulating SHBG, which retards testosterone clearance, creating a slower circulating half-time of testosterone. This order-of-magnitude difference in circulating testosterone concentrations is the key factor in the sex difference in athletic performance due to androgen effects principally on muscle, bone, and hemoglobin.

Muscle

Biology

It has been known since ancient times that castration influences muscle function. Modern knowledge of the molecular and cellular basis for androgen effects on skeletal muscle involves effects due to androgen (testosterone, DHT) binding to the AR that then releases chaperone proteins, dimerizes, and translocates into the nucleus to bind to androgen response elements in the promoter DNA of androgen-sensitive genes. This leads to increases in (1) muscle fiber numbers and size, (2) muscle satellite cell numbers, (3) numbers of myonuclei, and (4) size of motor neurons (93). Additionally, there is experimental evidence that testosterone increases skeletal muscle myostatin expression (94), mitochondrial biogenesis (95), myoglobin expression (96), and IGF-1 content (97), which may augment energetic and power generation of skeletal muscular activity.

Customized genetic mouse models can provide unique experimental insight into mammalian physiology that is unobtainable by human experimentation.

"Sex differences in height, where they exist, are largely dependent on postpubertal differences in circulating testosterone."

The tight evolutionary conservation of the mammalian reproductive system explains why genetic mouse models have provided consistent, high-fidelity replication of the human reproductive system (98, 99). Genetic males (46,XY) with androgen insensitivity displaying similar features occur through the spontaneous production of inactivating AR mutations in all mammalian species studied, including humans, where they are known as women with CAIS. The converse, genetic females (46,XX) resistant to all androgen action cannot occur naturally in humans or other mammals. This is because fully androgen-resistant females must have both X chromosomes carrying an inactivated AR. In turn, this requires acquiring one X chromosome from their father, and hemizygous males bearing a single X chromosome with an inactive AR produce no sperm, as a functional AR is biologically indispensable for making sperm in any mammal. However, androgen-resistant females can be bred by genetic engineering using the Cre-Lox system (100). An important finding from such studies is that androgen-resistant female mice have essentially the same muscle mass and function as wild-type androgen-sensitive females bearing normal AR, whereas androgen-resistant male mice have smaller and weaker muscle mass and function than do wild-type males and comparable instead with wild-type females (101). This indicates that androgen action, represented by circulating testosterone, is the key determinant of the higher muscle mass and strength characteristic of males compared with females. Furthermore, endogenous circulating testosterone has minimal effects on skeletal muscle mass and strength in female mice because of its low levels. Although these experiments cannot be replicated in humans, their key insight is that the higher circulating testosterone in males is the determinant of the male's greater muscle mass and function compared with females. Nevertheless, there is also evidence that hyperandrogenic women, mostly with PCOS, have increased muscle mass and strength that correlates with mildly increased circulating testosterone in the high-normal female range (36, 47).

Observational data

There is a clear sex difference in both muscle mass and strength (102–104) even adjusting for sex differences in height and weight (104, 105). On average, women have 50% to 60% of men's upper arm muscle cross-sectional area and 65% to 70% of men's thigh muscle cross-sectional area, and women have 50% to 60% of men's upper limb strength and 60% to 80% of men's leg strength (106). Young men have on average a skeletal muscle mass of >12 kg greater than age-matched women at any given body weight (104, 105). Whereas numerous genes and environmental factors (including genetics, physical activity, and diet) may contribute to muscle mass, the major cause of the sex

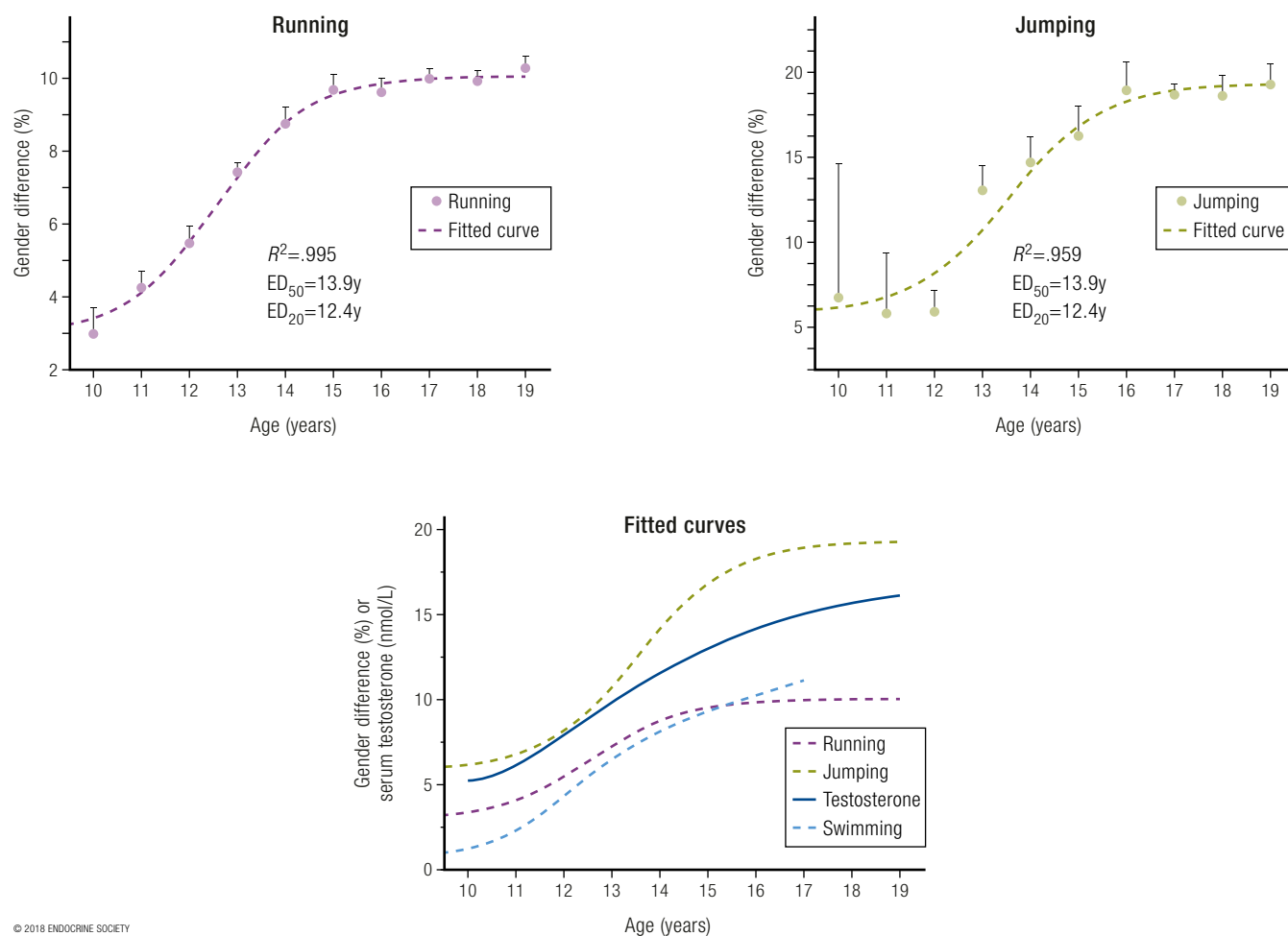
difference in muscle mass and strength is the sex difference in circulating testosterone.

Age-grade competitive sports records show minimal or no female disadvantage prior to puberty, whereas from the age of male puberty onwards there is a strong and ongoing male advantage. Corresponding to the endogenous circulating testosterone increasing in males after puberty to 15 to 20 nmol/L (sharply diverging from the circulating levels that remain <2 nmol/L in females), male athletic performances go from being equal on average to those of age-matched females to 10% to 12% better in running and swimming events, and 20% better in jumping events (8) (Fig. 1). Corroborative findings are provided by a Norwegian study that examined performance of adolescents in certain athletic events but without reference to contemporaneous circulating testosterone concentrations (107). The striking postpubertal increase in male circulating testosterone provides a major, ongoing, cumulative, and durable advantage in sporting contests by creating greater muscle mass and strength. These sex differences render women unable to compete effectively against men, especially (but not only) in power sports.

These findings are supported by studies of non-athletic women showing that muscle mass is increased in proportion to circulating testosterone in women with mildly elevated testosterone levels due to PCOS (108, 109), a condition that is more prevalent among elite female athletes who exhibit these features (36, 45, 47), often undiagnosed (46), but that may provide an ergogenic advantage (47), consistent with the graded effects of circulating testosterone on explosive performance in men and women (110).

Studies of elite female athletes further corroborate these findings. One study demonstrates dose-response effects of better performance in some (400 m running, 400 m hurdles, 800 m running, hammer throw, pole vault) but not all athletic events correlated with significantly higher endogenous testosterone in female, but not male, athletes. Even within the low circulating testosterone levels prevailing within the normal female range, in these events there was a significant advantage of 1.8% to 4.5% among those in the highest tertile compared with the lowest tertile of endogenous testosterone (35). A further study of elite female athletes corroborates and extends these observations in that endogenous androgens are associated with a more anabolic body composition as well as enhanced muscular performance (36). In this study, 106 Swedish Olympic female athletes were compared with 117 age- and weight (body mass index)-matched sedentary control women for their muscle and bone mass (by dual-energy X-ray absorptiometry), their muscular strength (squat and countermovement jumps), and testosterone and DHT, as well as androgen precursors (dehydroepiandrosterone, androstenedione) and urinary androgen glucuronide metabolites (androsterone,

Figure 1. Sex differences in performance (in percentage) according to age (in years) in running events, including 50 m to 2 miles (upper left panel), and in jumping events, including high jump, pole vault, triple jump, long jump, and standing long jump (upper right panel) [for details, see Ref. (8)]. The lower panel is a fitted sigmoidal curve plot of sex differences in performance (in percentage) according to age (in years) in running, jumping, and swimming events, as well as the rising serum testosterone concentrations from a large dataset of serum testosterone of males. Note that in the same dataset, female serum testosterone concentrations did not change over those ages, remaining the same as in prepubertal boys and girls. Data are shown as mean and SEM of the pooled sex differences by age. Reproduced with permission from Handelsman DJ. Sex differences in athletic performance emerge coinciding with the onset of male puberty. *Clin Endocrinol (Oxf)*. 2017;**87**:68–72.



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etiocholanolone, 3 and 17 3α -diols) measured by LC-MS (36). The athletes displayed higher muscle (and bone) mass than did the sedentary control women, with strength tests correlating strongly with muscle mass whether in total or just in the legs. In turn, muscle mass and strength were correlated with androgens and androgen precursors. Considering that such studies may be confounded by factors such as menstrual phase and dysfunction, as well as heterogeneous sports disciplines, which weaken the power of the study, these findings can be regarded as quite robust.

Interventional data

Dose-response studies show that in men whose endogenous testosterone is fully suppressed, add-back administration of increasing doses of testosterone that produce graded increases in circulating testosterone causes a

dose-dependent (whether expressed according to testosterone dose or circulating levels) increase in muscle mass (measured as lean body mass) and strength (65, 111). Taken together, these studies prove that testosterone doses leading to circulating concentrations from well below to well above the normal male range have unequivocal dose-dependent effects on muscle mass and strength. These data strongly and consistently suggest that the sex difference in lean body mass (muscle) is largely, if not exclusively, due to the differences in circulating testosterone between men and women. These findings have strong implications for power-dependent sport performance and largely explain the potent efficacy of androgen doping in sports.

The key findings providing conclusive evidence that testosterone has prominent dose-response effects in men are reported in studies by Bhasin and colleagues that proved a monotonic dose response,

extending from subphysiological to supraphysiological range for men for testosterone effects on muscle mass, size, and strength in healthy young men, findings that have been replicated and confirmed by an independent group (65). Both sets of studies used a common design of fully suppressing all endogenous testosterone (to castrate levels) for the full duration of the experiment by administering a GnRH analog. In the Bhasin and colleagues studies, participants were then randomized to five groups and each received weekly injections of 25 mg, 50 mg, 125 mg, 300 mg, or 600 mg of testosterone enanthate for 20 weeks. In effect, this was two subphysiological and two supraphysiological testosterone doses. In these studies, the lowest testosterone dose produced a mean serum testosterone of 253 ng/dL (8.8 nmol/L) in younger men and 176 ng/dL (6.1 nmol/L) in older men. The studies showed a consistent dose response for muscle mass and strength that was clearly related to testosterone dose and consequential blood testosterone concentrations (Fig. 2, upper panel).

The study of Finkelstein *et al.* (65) involved the same design and involved 400 healthy men aged 20 to 50 years who had complete suppression of endogenous testosterone for the 16 weeks of the study, with testosterone added back using daily doses of 0, 1.25 g, 2.5 g, 5 g, or 10 g of a topical 1% testosterone gel. This again created a graded dose-response curve for serum testosterone and for muscle mass and strength. The inclusion of a 0 (placebo) dose allowed differentiation between the 0 and lowest testosterone dose. The placebo (0) dose produced a serum testosterone of 0.7 nmol/L (the typical mean for castrated men, childhood, and women of any age). Meanwhile, the lowest testosterone dose (1.25 g of gel per day) produced a serum testosterone of 6.9 nmol/L, which is equivalent to that of a male in early to middle puberty. A key finding for this review is that, from this study of men, the increase in serum testosterone from mean of normal female concentration (0.9 nmol/L) to supraphysiological female concentrations (6.9 nmol/L) produced significant increases of 2.3% for total body lean (muscle) mass, 3.0% for thigh muscle area, and 5.5% increase in leg press strength (digitized data pooling of both cohorts from lower panel, Fig. 2).

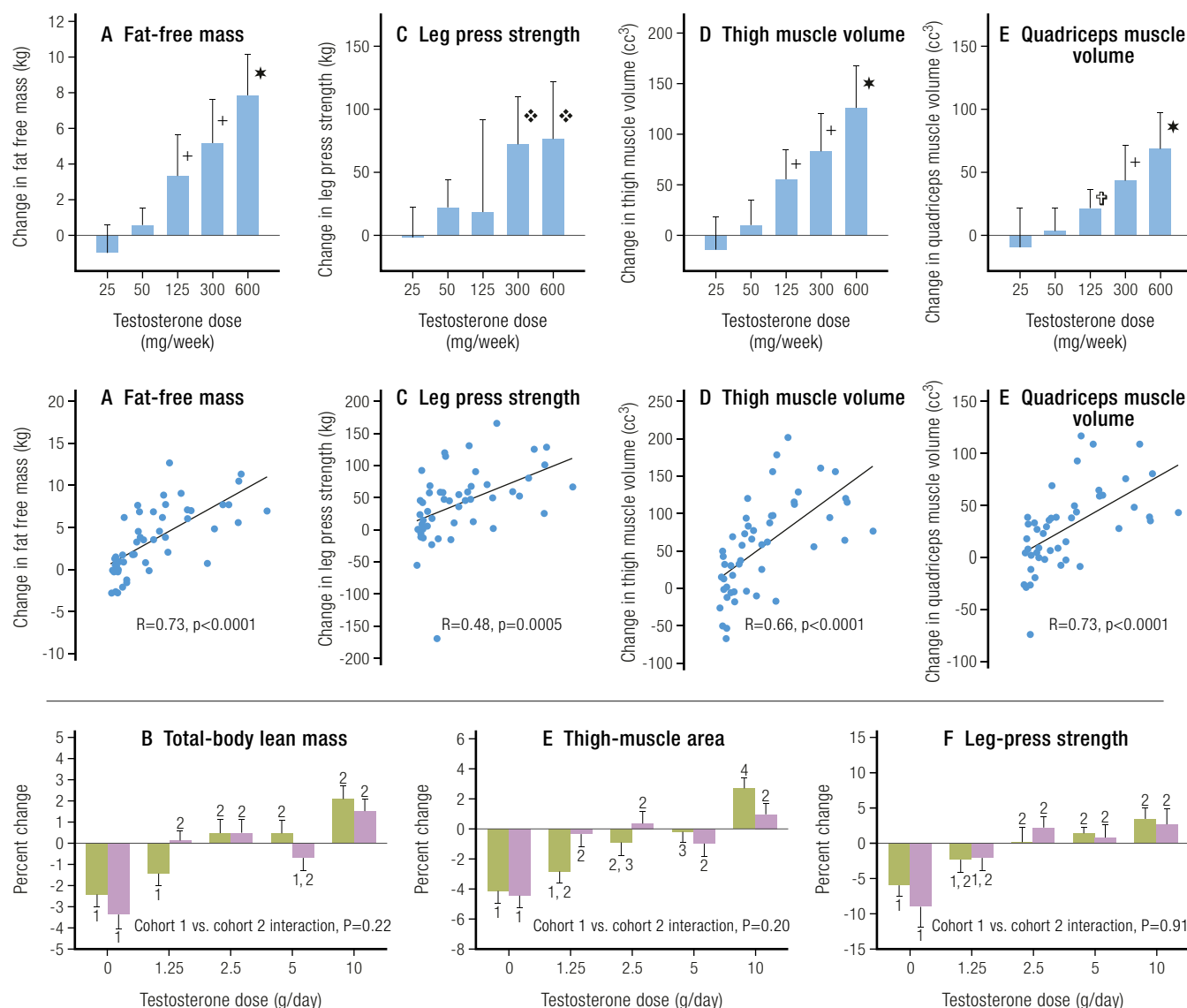
Studies of the ergogenic effects of supraphysiological concentrations of circulating testosterone require studies administering graded doses of exogenous testosterone for months. Owing to ethical concerns regarding risks of unwanted virilization and hormone-dependent cancers, however, few studies have administered supraphysiological testosterone doses to healthy women. One well-designed, randomized placebo-controlled study of postmenopausal women investigated the effects of different testosterone doses on muscle mass and performance and physical function (112). Sixty-two women (mean age, 53 years) all had a standard estrogen-replacement dose administered during a 12-week run-in period (to

eliminate any hypothetical confounding effects of estrogen deficiency), after which they were randomized to one of five groups receiving weekly injections of testosterone enanthate (doses: 0, 3 mg, 6.25 mg, 12.5 mg, and 25 mg, respectively) for 24 weeks. The increasing doses of testosterone produced an expected dose response in serum testosterone concentrations (by LC-MS), with the highest testosterone dose (25 mg/wk) producing a mean nadir concentration of 7.3 nmol/L. The women whose testosterone concentrations were increased to 7.3 nmol/L achieved significant increases in muscle mass and strength (Table 4), ranging from 4.4% for muscle (lean) mass to between 12% and 26% for measures of muscle strength (chest and leg press, loaded stair climb). As muscle strength measurement is effort-dependent, the placebo-controlled design of the Huang *et al.* (112) study supports the further interpretation that the highest dose of testosterone also had prominent mental motivational effects in the effort-dependent tests of muscle strength. These findings provide salient direct evidence of the ergogenic effects of hyperandrogenism in female athletes confirming that at least up to average circulating testosterone concentrations of 7.3 nmol/L, women display a dose-response relationship similar to that of men, with supraphysiological doses of testosterone leading to significant gains in muscle mass and power.

These effects of testosterone administration on circulating testosterone concentrations and muscle mass and strength in females may be compared with the effects in males from the Finkelstein *et al.* (65) and Bhasin and colleagues studies. In men, the lowest testosterone dose (1.25 g/d) increased mean serum testosterone to 6.9 nmol/L (equivalent to levels seen in early to middle male puberty), resulting in significant increases of total body lean (muscle) mass (2.3%), thigh muscle area (3.0%), and leg press strength (5.5%) compared with the placebo dose that resulted in a serum testosterone of 0.7 nmol/L. In the Huang *et al.* (112) study (Fig. 3), muscle mass and strength in postmenopausal women displayed a flat response at the three lower doses, when circulating testosterone concentrations remain <5 nmol/L, and displayed a significant increase only when the mean circulating testosterone concentration produced by the highest testosterone dose first increased circulating testosterone concentrations >5 nmol/L. This pattern, flat at lower doses and rising at the highest dose, represents the lower plateau and the earliest rising portion, respectively, of the sigmoidal dose-response curve of testosterone for muscle.

Data corroborating the Huang *et al.* study results comes from another well-controlled study in which postmenopausal women who were administered methyl testosterone following a run-in period of estrogen replacement displayed a significant increase in lean (muscle) mass as well as upper and lower limb

Figure 2. Strong dose-response relationship between testosterone dose and circulating concentration with muscle mass and strength in men. The upper panels [from Bhasin *et al.* (111)] display the strong dose-response relationships of muscle mass shown as (A) “lean” or “fat-free” mass or volume of (D) thigh and (E) quadriceps muscle and (C) of leg muscle strength with increasing testosterone dose (upper row) or circulating concentration (middle row). Serum testosterone concentrations are in US units (ng/dL; divide by 28.8 to get nmol/L). Adapted with permission from Bhasin S, Woodhouse L, Casaburi R, *et al.* Testosterone dose-response relationships in healthy young men. *Am J Physiol Endocrinol Metab.* 2001;281:E1172–E1181. The lower panels [from Finkelstein *et al.* (65)] show the strong dose-response relationships of (B) whole-body muscle mass, (E) thigh muscle mass, and (F) leg press strength with increasing testosterone dose. Cohorts 1 and 2 were treated with the same increasing doses of testosterone but either without (green fill, cohort 1) or with (purple fill, cohort 2) an aromatase inhibitor (anastrozole), which prevents conversion of testosterone to estradiol. The differences between cohorts (*i.e.*, use of anastrozole) was not significant for muscle mass and strength and can be ignored with results of the two cohorts being pooled. Reproduced with permission from Finkelstein JS, Lee H, Burnett-Bowie SA, Pallais JC, *et al.* Gonadal steroids and body composition, strength, and sexual function in men. *N Engl J Med* 2013;369:1011–1022.



power during a 16-week double-blind, parallel group study (113).

Similarly, two prospective studies of the first 12 months of treatment of transmen [female-to-male

(F2M) transgender] shows a consistent major increase in muscle mass and strength due to testosterone administration. In one study testosterone treatment of 17 transmen achieving adult male circulating testosterone levels

Table 4. Effects of Testosterone on Muscle Mass and Strength in Women

Androgen-Sensitive Variable	Baseline	Increase	% Increase
Lean muscle mass, kg	43 ± 6	1.9 ± 0.5	4.4
Chest press, W	100 ± 26	26 ± 7	26
Leg press, N	744 ± 172	90 ± 30	12
Loaded stair-climb power, W	406 ± 77	56 ± 13	14

With data from Huang G, Basaria S, Travison TG, *et al.* Testosterone dose-response relationships in hysterectomized women with or without oophorectomy: effects on sexual function, body composition, muscle performance and physical function in a randomized trial. *Menopause* 2014;21:612–623. Data are shown as mean and SEM derived from Table 1 and digitized from Figure 4 from Huang *et al.* (112) showing the effects of testosterone (mean circulating concentration, 7.3 nmol/L) on muscle mass and strength in women treated with the highest testosterone dose (n = 11; 25 mg of testosterone enanthate per week).

(mean, 31 nmol/L) increased muscle mass by 19.2% (114). In a second study, 23 transmen administered adult male testosterone doses also produced striking increases in total body muscle size and limb muscle size (by 6.5% to 16.6%) and grip strength (by 18%) compared with age-matched untreated control women (115). Conversely, testosterone suppression (using an estrogen-based treatment regimen) in 20 transwomen (M2F transgender) that reduced circulating testosterone levels from adult male range to adult female range led to a 9.4% reduction in muscle mass (measured as cross-sectional area).

Effects on athletic performance

Muscle growth, as well as the increase in strength and power it brings, has an obvious performance-enhancing effect, in particular in sports that depend on strength and (explosive) power, such as track and field events (107, 110). There is convincing evidence that the sex differences in muscle mass and strength are sufficient to account for the increased strength and aerobic performance of men compared with women and is in keeping with the differences in world records between the sexes (116). The basis for the sex difference in muscle mass and strength is the sex difference in circulating testosterone as clearly shown (for example) by (1) the enhanced athletic performance of men compared with prepubertal boys and women (8); (2) the close correspondence of muscle growth (muscle size) with muscle strength in ascending dose studies in men by Bhasin *et al.* (111, 117–119) and Finkelstein *et al.* (65) and in postmenopausal women by Huang *et al.* (112); (3) the effect of male castration in reducing muscle size and strength, effects that are fully rectified by testosterone replacement; and (4) the striking efficacy of androgen doping on the sports performances of German Democratic Republic female athletes (120).

Hemoglobin

Biology

It is well known that levels of circulating hemoglobin are androgen-dependent and consequently higher in men than in women by 12% on average; however, the physiological mechanism by which androgens such as

testosterone boosts circulating hemoglobin is not fully understood (121). Testosterone increases secretion of and sensitivity to erythropoietin, the main trophic hormone for erythrocyte production and thereby hemoglobin synthesis, as well as suppressing hepcidin (122), a crucial iron regulatory protein that governs the body's iron economy. Hepcidin has to balance the need for iron absorption from foods (the only source of iron required for the body's iron-containing proteins) against the fact that the body has no mechanism to shed excess iron, which can be toxic. Adequate iron availability is essential for normal erythropoiesis and synthesis of key heme, iron-containing oxygen-transporting proteins such as hemoglobin and myoglobin (123) as well as other iron-dependent proteins such as cytochromes and DNA synthesis and repair enzymes. Experimental evidence in mice shows that testosterone increases myoglobin content of muscle with potential for augmenting aerobic exercise performance (96), but this has not been evaluated in humans.

Increasing the amount of hemoglobin in the blood has the biological effect of increasing oxygen transport from lungs to tissues, where the increased availability of oxygen enhances aerobic energy expenditure. This is exploited to its greatest effect in endurance sports (1). The experiments of Ekblom *et al.* (124) in 1972 (Fig. 4) demonstrated strong linear relationships between changes in hemoglobin [due to withdrawal or retransfusion of 1, 2 or 3 U (400 mL) of blood] and aerobic capacity, established by repeated testing of maximal exercise-induced oxygen consumption before and after each procedure (124). As already noted, circulating hemoglobin levels are on average 12% higher in men than women (125). It may be estimated that as a result the average maximal oxygen transfer will be ~10% greater in men than in women, which has a direct impact on their respective athletic capacities.

Observational data

The proposition that the sex difference in circulating hemoglobin levels is likely to be due to the sex difference in average circulating testosterone concentrations is supported by the fact that male castration (*e.g.*, for advanced prostate cancer) (126) and androgen deficiency due to reproductive system disorders (127) reduce circulating

hemoglobin in men, eliminating the sex difference, whereas testosterone replacement therapy restores circulating hemoglobin to adult male levels (121, 127, 128).

An unusually informative observational study of women with CAH provides unique insight into testosterone effects on circulating hemoglobin in otherwise healthy women (92). Women with CAH require glucocorticoid replacement therapy but exhibit widely varying levels of hormonal control (79). The degree of poor control is associated with increasing levels of circulating testosterone ranging from normal female concentrations up to 36 nmol/L, and these levels correlate closely ($r = 0.56$) with levels of circulating hemoglobin (Fig. 5). Interpolating from the dose-response regression, increases in circulating testosterone measured by LC-MS from 0.9 nmol/L to 5 nmol/L, 7 nmol/L, 10 nmol/L, and 19 nmol/L were associated with increases in circulating hemoglobin of 6.5%, 7.8%, 8.9%, and 11%, respectively, establishing a strong dose-response relationship. An 11% increase in circulating hemoglobin translates to a 10% difference in maximal oxygen transfer (124), which may account for virtually all the 12% sex difference in male and female circulating hemoglobin (125). To put this into context, any drug that achieved such increases in hemoglobin would be prohibited in sports for blood doping, as this difference is sufficient to have ergogenic effects, even without taking into account any testosterone effects on muscle mass or strength (for which data were not available in that study). Conversely, among elite female athletes with circulating testosterone in the healthy premenopausal female range, circulating hemoglobin does not correlate with athletic performance (35). In women with the mild hyperandrogenism of PCOS, circulating hemoglobin and hematocrit are reported as not (129) or marginally increased (130), findings that may be influenced by the fact that PCOS is

associated with reduced or absent menstruation, thereby reducing the iron loss of regular menstruation.

Interventional data

In the Bhasin *et al.* (111) studies, in both young and older men the highest testosterone dose produced a 12% increase in blood hemoglobin compared with the lowest dose, reflecting a strong dose-response relationship (Fig. 6) (131). Analogous findings were reported for testosterone treatment effects in postmenopausal women where the highest dose (25 mg weekly) of testosterone, which increased mean serum testosterone to 7.3 nmol/L, had the largest increase (3%) in blood hemoglobin and hematocrit (112).

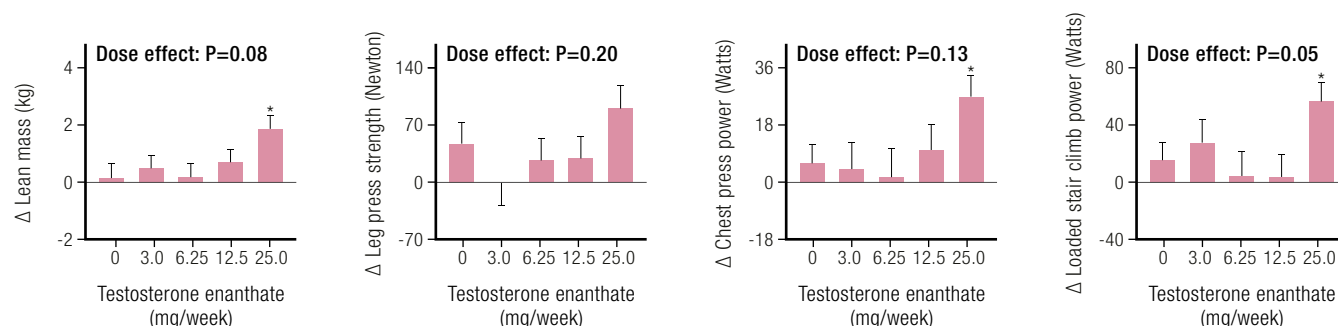
Corroborative findings are available from studies of transmen (F2M transgender), that is, natal females who subsequently receive testosterone treatment at replacement doses to create adult male circulating testosterone concentrations, who exhibit increases in circulating hemoglobin to male levels [reviewed in (132–134)]. Testosterone treatment in 17 (F2M) transmen that created mean circulating testosterone levels of 31 nmol/L also increased hemoglobin levels by 15% (114). Conversely, one prospective 12-month study of transgender (nonathlete) individuals reported that testosterone suppression (by an estrogen-based regimen) to normal female levels in 20 (M2F) transwomen reduced hemoglobin by 14%.

If such an increase in hemoglobin were produced by any chemical substance, it would be considered doping, according to the World Anti-Doping Code.

Bone

Biology

There is extensive experimental evidence from genetic mouse models showing that the sex differences in bone

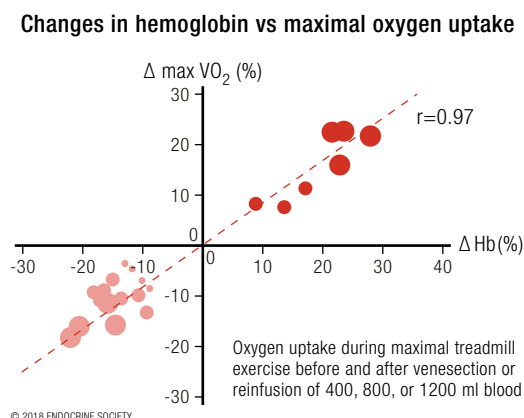


* Significant difference between mean on treatment change in dose group vs. placebo at 0.05 level. The significance level for the overall dose effect is by likelihood ratio test.

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Figure 3. From Huang *et al.* (112): Dose-response effects on lean (muscle) mass and three measures of muscle strength as a result of increasing doses of weekly testosterone enanthate injections in women. Note the effects on all four parameters (three statistically significant) of the highest testosterone dose, the only one that produced circulating testosterone levels exceeding the normal female range. Reproduced with permission from Huang G, Basaria S, Travison TG, *et al.* Testosterone dose-response relationships in hysterectomized women with or without oophorectomy: effects on sexual function, body composition, muscle performance and physical function in a randomized trial. *Menopause* 2014;21:612–623.

Figure 4. Redrawn results from Ekblom *et al.* (124). Results from the transfusion of additional blood are shown in dark red circles and those after blood withdrawal in light red circles. Adapted with permission from Ekblom B, Goldbarg AN, Gullbring B. Response to exercise after blood loss and reinfusion. *J Appl Physiol* 1972;33:175–180.



size, mass, and function are due to the sex difference in circulating testosterone. These effects have been reported from studies of global and tissue or cell-selective inactivation of ARs or estrogen receptors that show that androgen effects are mediated by both direct effects on the AR as well as indirect effects mediated via aromatization of testosterone to estradiol to act on estrogen receptors [reviewed in (135)]. Bone grows in length due to epiphyseal chondral growth plates that provide cartilage, forming the matrix for lengthening of long bone, which is terminated by an estrogen-dependent mechanism that depends on aromatization of testosterone to estradiol. Similarly, bone width and density are increased through appositional growth from periosteal and endosteal expansion that depend on bone loading and androgen exposure together with other factors. An important difference between androgen effects on bone compared with effects on muscle or hemoglobin is that developmental bone effects of androgens are likely to be irreversible.

Observational data

Men have distinctively greater bone size, strength, and density than do women of the same age. As with muscle, sex differences in bone are absent prior to puberty but then accrue progressively from the onset of male puberty due to the sex difference in exposure to adult male circulating testosterone concentrations [reviewed in (135)]. The earlier onset of puberty and the related growth spurt in girls as well as earlier estrogen-dependent epiphyseal fusion explains shorter stature of girls than boys. As a result, on average men are 7% to 8% taller with longer, denser, and stronger bones, whereas women have shorter humerus and femur cross-sectional areas being 65% to 75% and 85%, respectively, those of men (106).

These changes create an advantage of greater bone strength and stronger fulcrum power from longer bones. Additionally, whereas passing through puberty enhances male physical performance, the widening of the female pelvis during puberty, balancing the evolutionary demands of obstetrics and locomotion (136, 137), retards the improvement in female physical performance, possibly driven by ovarian hormones rather than the absence of testosterone (138, 139).

Sex differences in height have been the most thoroughly investigated measure of bone size, as adult height is a stable, easily quantified measure in large population samples. Extensive twin studies show that adult height is highly heritable with predominantly additive genetic effects (140) that diverge in a sex-specific manner from the age of puberty onwards (141, 142), the effects of which are likely to be due to sex differences in adult circulating testosterone concentrations.

Bone density (total and medullary cross-sectional area) is increased in women with CAH with variably elevated serum testosterone (including into the male range) when it is only partially suppressed by glucocorticoid treatment (143), although more effective glucocorticoid suppression lowers bone density (144).

Interventional data

Well-designed, placebo-controlled direct interventional studies of supraphysiological androgen effects on bone in females are few, rarely feasible, and unlikely to be performed for ethical and practical reasons. Unlike muscle, which responds relatively rapidly to androgen effects so that muscle studies in humans can be completed within 3 to 4 months (65, 111, 112, 119, 145), comparable bone studies would typically take a year or more to reach plateau effects. Hence, such direct investigational studies in otherwise healthy women would risk side effects of virilization that may be only slowly and partly reversible, if at all, as well as potential promotion of hormone-dependent cancers making such studies ethically and practically not feasible.

Effects on athletic performance

The major effects of men's larger and stronger bones would be manifest via their taller stature as well as the larger fulcrum with greater leverage for muscular limb power exerted in jumping, throwing, or other explosive power activities. The greater cortical bone density and thereby resistance to long bone fractures is unlikely to be relevant to the athletic performance of young athletes, in whom fractures during competition are extremely rare and not expected to be linked to sex. Alternatively, stress fractures in athletes, mostly involving the legs, are more frequent in females with the male protection attributable to their larger and thicker bones (146).

Other androgen-sensitive sex dichotomous effects

Biology and observational data

Many if not most other aspects of physiology exhibit sex differences and may therefore enhance the impact of the male advantage in sports performance of the dominant determinants (muscle and hemoglobin). Examples include sex differences in exercise-induced cardiac (147, 148) and lung (149) function and mitochondrial biogenesis and energetics (95). However, the limited knowledge of the magnitude and hormonal mechanisms involved, specifically the degree of androgen dependence of these mechanisms, means that it is difficult to estimate their contribution, if any, toward the sex difference in athletic performance. The sex difference in pulmonary function may be largely explained by the androgen-sensitive sex difference in height, which is a strong predictor of lung capacity and function (149). Further physiological studies of the androgen dependence of other physiological sex differences are awaited with interest.

Psychological differences between men and women on mental function (e.g., rotational orientation) (150) as well as mood, motivation, and behavioral effects may involve androgen-sensitive effects during pre-natal and perinatal as well as postpubertal effects (151, 152).

Interventional data

There is some limited direct evidence from well-designed, placebo-controlled trials that administration of testosterone or other androgens at supraphysiological doses directly affect mood and behavior, notably inducing hypomania (153). In a randomized placebo-controlled study of testosterone administration in postmenopausal women (112), in case of those receiving the highest dose (the only one causing circulating testosterone levels to exceed the normal female range), there was not only an increase in muscle mass (4.4%) but a strikingly greater increase in muscle strength (12% to 26%), suggesting an enhanced mental motivational effect of testosterone on the effort-dependent tests of muscle strength.

Alternative Mechanisms Proposed to Explain Sex Differences in Athletic Performance

Alternative explanations for the sex difference in athletic performance, other than it being due to the sex difference in postpubertal circulating testosterone, have been proposed, including (1) sex differences in height because height is a predictor of muscle mass (116), (2) genetic sex differences due to the influence of unspecified Y chromosome genes (154), and (3) sex differences in GH secretion (116).

Effects of height

One proposal has been that, as men are taller than women, height differences may explain the sex differences in muscle mass and function, which explains some athletic success (116). Numerous factors contribute to the regulation of adult muscle mass, including genetics, race, adiposity, hormones, physical activity (exercise/training), diet, birth order, and bone size (including height) [reviewed in (155)]. Among the nonhormonal factors, genetics explains a large proportion [~50% to 60% from pooled twin studies (156)] of the variability in muscle mass and strength (157, 158) and may be explained in turn by the equally high genetic contributions to circulating testosterone (37, 38). Some factors influencing muscle mass and strength such as physical activity, adiposity, and bone size are also partly androgen-dependent. Prior to puberty there is no sex difference in skeletal features, including height (159, 160). However, with the onset of puberty, girls aged 11 and 12 years are transiently taller than peer-aged boys due to their earlier onset of the female pubertal growth spurt, but from the age of 14 years onward the taller stature in males emerges and stabilizes (141). Hence, similar to muscle mass, sex differences in bone size (including length, density, and height) arise after male puberty establishes the marked dichotomy between men and women in adult circulating testosterone concentrations. Taller height is

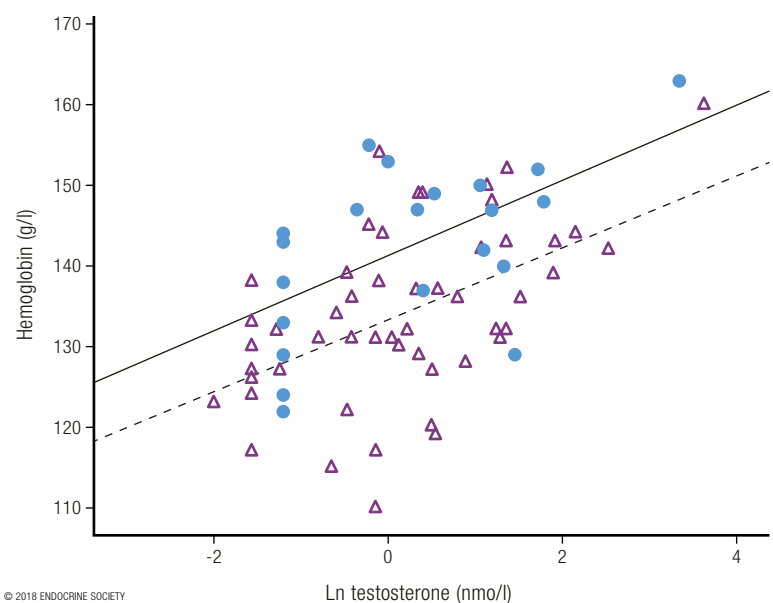


Figure 5. Plot of circulating hemoglobin against the natural logarithm of serum testosterone in women with congenital adrenal hyperplasia [from Karunasena *et al.* (92)]. The filled circles represent a cohort where serum testosterone was measured by immunoassay. The open triangles denote a second cohort, where serum testosterone was measured by LC-MS. Note the systematic overestimation of testosterone by the immunoassay used in cohort 1 vs LC-MS measurement in cohort 2. Despite that overestimation, however, the correlations were similar in both cohorts. Reproduced under a Creative Commons BY-NC-ND 4.0 license from Karunasena N, Han TS, Mallappa A, *et al.* Androgens correlate with increased erythropoiesis in women with congenital adrenal hyperplasia. Clin Endocrinol (Oxf) 2017;86:19–25.

advantageous in some sports (basketball, some football codes, combat sports), but in others (horse racing jockeys, cycling, gymnastics, weightlifting, bodybuilding) short stature provides a greater power/strength-to-weight ratio as well as superior rotational balance, speed, and agility. However, the male advantages in speed, strength, and endurance apply regardless of whether height is advantageous. Hence, the sex differences in height, where they exist, are largely dependent on postpubertal differences in circulating testosterone when sex differences in height are first expressed.

Genetic effects of Y chromosome

It has also been proposed that the sex difference in athletic performance may be due to genetic effects of an unspecified Y chromosome gene that may dictate taller stature (154), as height is correlated with men's greater muscle mass. The small human Y chromosome has few functional genes and none with a known effect on height other than the short stature homeobox (SHOX) gene, located in the pseudoautosomal regions of the tip of the short arms of X and Y chromosomes (161). Adult height displays an apparent dose dependency on SHOX gene copy number that is a major factor contributing to explaining both the short stature of 45,XO females (Turner syndrome), who have a single copy of the SHOX gene, as well as the tall stature of 47,XXY males (Klinefelter syndrome), who have three copies (161). However, when SHOX copy number is the same, men with additional supernumerary Y chromosomes (e.g., 47,XYY) are the same height as 47,XXY men (162). Hence, there is no evidence supporting dosage-dependent Y chromosomal gene effects on height independent of SHOX gene copy number, nor does men's possession of a Y chromosome explain the height difference between adult men and women. On the contrary, the tall stature of 47,XXY men is at least partly due to the concomitant androgen deficiency leading to pubertal

delay. Pubertal delay prolongs long bone growth due to delayed epiphyseal closure, an estrogen-dependent effect that requires adequate production of testosterone as a substrate for aromatization to estradiol, resulting in tall stature. Similar eunuchoidal features and taller stature are evident in 46,XY men with congenital hypogonadotropic hypogonadism (Kallmann syndrome and its variants) with comparable congenital onset of androgen deficiency, also manifest as pubertal delay and long bone overgrowth. Hence, taller height is better explained by impaired testicular function with delayed puberty and epiphyseal closure rather than unspecified Y chromosome dosage effects. In any case, rare aneuploidies in themselves do not explain the sex difference in height in the general population of individuals with normal sex chromosomes.

Growth hormone

The proposal that the sex difference in muscle mass and function might be due to sex differences in endogenous GH secretion (116) is refuted by the extensive and conclusive clinical evidence that endogenous GH secretion in young women is consistently higher (typically twice as high) as in young men of similar age (163–170). Those findings cannot explain the male advantage in muscle mass and strength unless GH retards muscle growth/function, for which there is no evidence. Furthermore, estrogens inhibit GH-dependent, hepatic IGF-1 production, the major pathway of GH action (171, 172). The weak observational association between low circulating IGF-1 and some, but not other, measures of weak muscle strength and limited mobility among older women may reflect general age-associated debility rather than any specific hormonal effects (173). Finally, the evidence that endogenous GH plays no role in sex differences in muscle mass and function is supported by evidence from the most extensive interventional study of GH treatment to non-GH-deficient adults, daily GH administration for 8 weeks to healthy recreational athletes produced only marginally significant improvement in exercise performance of men and none in women (174). These findings are consistent with the speculation that GH (or IGF-1) may be an amplifier of testosterone effects and therefore be a consequence of the sex difference in circulating testosterone rather than its cause.

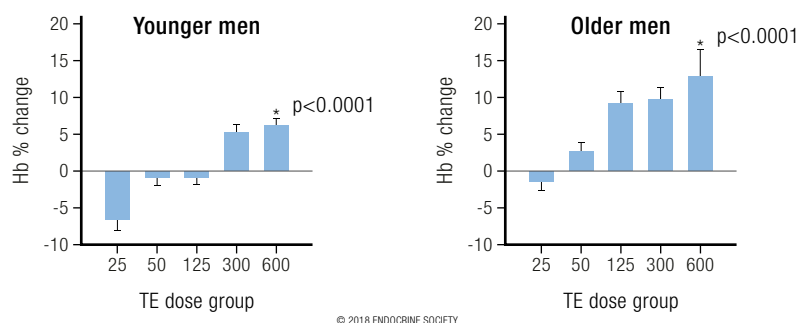


Figure 6. From Coviello *et al.* (131): Depicts the strong dose-response relationship between increasing testosterone dose with resulting change in blood hemoglobin in young and older men. Reproduced with permission from Coviello AD, Kaplan B, Lakshman KM, *et al.* Effects of graded doses of testosterone on erythropoiesis in healthy young and older men. *J Clin Endocrinol Metab* 2008;93:914–919.

The Impact of Adult Male Circulating Testosterone Concentrations on Sports Performance

Plausible estimates of the magnitude of the ergogenic advantage of adult male circulating testosterone concentrations are feasible from the limited available observational and interventional studies.

Population data on the ontogeny of puberty show that prior to puberty boys and girls have comparable athletic performance, whereas sex differences in athletic performance emerge coinciding with the rise in circulating testosterone from the onset of male puberty. Male puberty results in circulating testosterone concentrations rising from the prepubertal and female postpubertal range (<2 nmol/L) to adult male circulating testosterone concentrations (18). This is associated with a 10% to 12% better performance in running and swimming events and 20% enhancement in jumping events (8).

A minimal estimate of the impact of adult male testosterone concentrations on muscle size and strength in females is provided by the Huang *et al.* (112) study of postmenopausal women. In this study the highest testosterone dose (weekly injections of 25 mg of testosterone enanthate) increased mean circulating testosterone from 0.9 nmol/L to 7.3 nmol/L, which is equivalent to the circulating testosterone of boys in early to middle puberty. After 24 weeks of testosterone treatment, the increase in circulating testosterone concentrations led to significant increases in muscle size of 4.4% and in muscle strength of 12% to 26%. Given the limited testosterone dose (and concentration) as well as study duration, it is likely that these findings underestimate the magnitude of the impact that sex difference in circulating testosterone has on muscle mass and strength, and therefore on athletic performance.

Converse effects of reduced athletic performance in athletes who undergo suppression of circulating testosterone concentrations from those in the male into the female range have been reported. Among recreational (nonelite) athletes, an observational study showed a consistent deterioration in athletic performance of transwomen (M2F transgender) athletes corresponding closely to the suppression of circulating testosterone concentrations (175). Similarly, among elite athletes with circulating testosterone in the male range due to DSDs, comparable findings of athletic performance reduced by an average of 5.7% when circulating testosterone was suppressed from the male range to <10 nmol/L (176). Subsequently, when the IAAF hyperandrogenism rule was suspended in 2015, and so these elite athletes could train and compete with unsuppressed serum testosterone levels, their athletic performances increased by a similar amount. Additionally, circulating hemoglobin levels in these untreated DSD athletes were comparable with male athletes or with female athletes doping with erythropoietin (Fig. 7). However, when circulating testosterone was suppressed to <10 nmol/L the levels of circulating hemoglobin were 12% lower and again comparable with nondoped, non-DSD females, corresponding to the 12% magnitude of the sex difference in hemoglobin between men and women (125).

Congruent findings are also known for an elite female athlete whose serial athletic performance based on publicly available best annual times between 2008 and 2016 for the 800-m running event are depicted in relationship to the original 2011 IAAF hyperandrogenism regulation (Fig. 8).

Based on the established dose-response relationships, suppression of circulating testosterone to <10 nmol/L would not eliminate all ergogenic benefits of testosterone for athletes competing in female events. For example, according to the Huang *et al.* (112) study, reducing circulating testosterone to a mean of 7.3 nmol/L would still deliver a 4.4% increase in muscle size and a 12% to 26% increase in muscle strength compared with circulating testosterone at the normal female mean value of 0.9 nmol/L. Similarly, according to the Karunasena *et al.* (92) study, reducing circulating testosterone concentration to 7 nmol/L would still deliver 7.8% more circulating hemoglobin than the normal female mean value. Hence, the magnitude of the athletic performance advantage in DSD athletes, which depends on the magnitude of elevated circulating testosterone concentrations, is considerably greater than the 5% to 9% difference observed in reducing levels to <10 nmol/L.

The physiological mechanism underlying these observations is further strengthened by prospective controlled studies of initiation of cross-sex hormone treatment in transgender individuals (114, 177). These show that during the first 12 months muscle mass (area) was decreased by 9.4% and hemoglobin levels by 14% in 20 transwomen (M2F transgender) treated with an estrogen-based regimen that reduced circulating testosterone concentrations from the male range to the female range. Conversely, in 17 transmen (F2M transgender) treated for the first time with testosterone for 12 months (which increased circulating testosterone levels to a mean of 31 nmol/L), muscle mass increased by 19.2% and hemoglobin by 15% (114). The muscle mass findings remained stable between 1 and 3 years after initiation of treatment, although fat mass continued to change between 1 and 3 years of testosterone treatment (177). These studies did not report muscle strength, but other studies of testosterone dose-response relationships for muscle mass and strength show consistently positive correlation (65, 93, 117, 119), although with disproportionately greater effect on muscle strength than on muscle mass. Hence, the muscle mass estimates in these prospective treatment initiation studies in transgender individuals likely underestimate the muscle strength gains from elevated testosterone levels where the circulating testosterone markedly exceeds female range to be within the male range as occurs in severe hyperandrogenism of DSD females, poorly controlled transwomen (M2F transgender), or transmen (F2M transgender). These effects are also the biological

basis of the ergogenic efficacy of androgen doping in women.

Finally, to put these competitive advantages into context, the winning margin (the difference in performance by which a competitor misses a gold medal, any medal, or making the final) in elite athletic or swimming events during the last three Olympics is <1% equally for both male and female events (Table 5).

Gaps in Knowledge and Research Limitations

The major limitations on scientific knowledge of the impact of adult male circulating testosterone concentrations on the sex difference in athletic performance is the lack of well-designed studies. Ideally, these would need to replicate adult male circulating testosterone concentrations for sufficient time in women to investigate the effects on muscle, hemoglobin, bone, and other androgen-sensitive measures that display consistent sex dichotomy in the population. However, the ethical and safety concerns preventing such studies hitherto are likely to remain formidable obstacles due to the risk of unacceptable and potentially irreversible virilization as well as of promoting hormone-dependent cancers in women.

With the exception of one interventional study administering a relatively low testosterone dose (*i.e.*, low for males) to women (112), the available evidence comprises observational studies that can only examine the effects of serum testosterone within physiological female limits or sparse and mostly uncontrolled data from intersex/DSD athletes. Although the available observational findings in healthy females are informative, the key question is the magnitude and dose

response of effects at still higher circulating testosterone concentrations on the performances of women. Whereas a testosterone dose-response relationship has been established in women at relatively low (for men) testosterone dose and circulating concentrations, it remains unproven (even if clearly plausible) that the testosterone dose-response relationships established in men for muscle, hemoglobin, and bone can be extrapolated to women when they are exposed to higher circulating testosterone concentrations (*i.e.*, comparable with male levels). It is theoretically possible there could be differences between men and women in muscle responses to testosterone, as muscle cell populations might express genetic differences in androgen sensitivity (for which there are no data), or alternatively the long-term prior pattern of testosterone exposure from conception to adulthood might lead to differences in testosterone dose responsiveness after maturity. Although the dose-response relationship in women may be similar to what is seen in men, there is also anecdotal evidence that the dose-response curves may be left shifted so that testosterone has greater potency in women than in men at comparable doses and circulating levels. The prediction is supported by the anecdotal evidence from the surreptitious East German national doping program in which the supervising doctors asserted from their experience of illicit cheating that androgens had more potent ergogenic effects in women than in men (120), a speculative opinion shared by many experienced sports medicine physicians.

There is no known means of increasing endogenous testosterone in women to anything like the requisite degree to attempt to answer these questions. In healthy men, circulating testosterone originates almost exclusively from a single source (testicular Leydig cells) and is subject to tight hypothalamic negative feedback control, so that either direct stimulation (by human chorionic gonadotropin) or indirect reflex effects (*e.g.*, from estrogen blockers operating via negative feedback) to enhance Leydig cell testosterone secretion are feasible. However, similar mechanisms do not operate in women, in whom circulating testosterone originates from three different sources (adrenal, ovary, extraglandular conversion of androgen precursors), none of which is subject to tight testosterone negative feedback control. As a result, it is not feasible to produce a sufficient increase in circulating testosterone in women either by direct ovarian stimulation or indirect reflex effects to test this hypothesis even if doing so were deemed ethical and safe. Alternatively, carefully controlled, graded-dose studies in F2M transgender individuals might be informative but are largely lacking at this time.

Hence, the only feasible design of such studies would be testosterone (or another androgen) administration to healthy young women. The only well-designed, placebo-controlled study of testosterone in

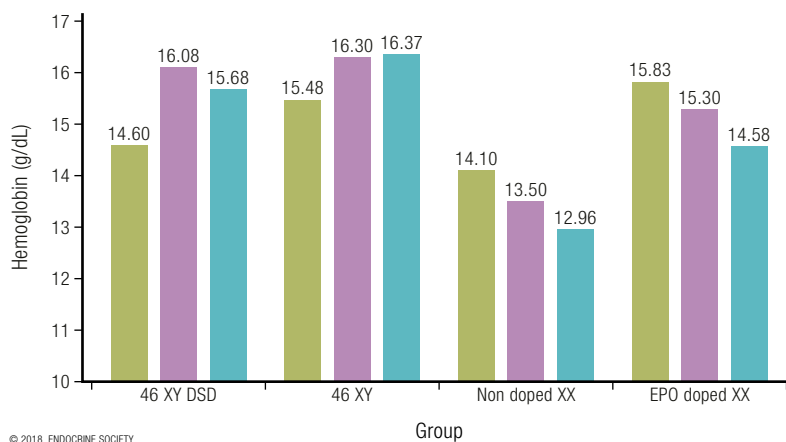


Figure 7. Mean hemoglobin concentrations (g/dL) of 12 elite athletes in 4 groups of 3 XY or XX middle-distance runners. The hemoglobin concentrations were collected as a part of the Athlete Biological Passport and analyzed according to the World Anti-Doping Agency standard methods. Each bar (athlete) is the mean of a minimum of three blood samples. In the 46,XY DSD group, blood was collected in a period when the athlete was not undergoing hormonal suppressive treatment.

otherwise healthy postmenopausal women was restricted to relatively low testosterone doses that, although clearly supraphysiological for women, were only 20% to 25% of male testosterone replacement doses (112). We are currently performing a double-blind, randomized, placebo-controlled study of the effects of moderately increased testosterone concentration on physical performance and behavior in young healthy women (ClinicalTrials.gov no. NCT03210558). However, obtaining ethical approval to administer supraphysiological testosterone doses that maintain circulating testosterone in the male range for sufficiently prolonged periods, as well as the practical difficulties in recruitment, are likely to remain obstacles to definitive resolution of this question.

In men, analogous ethical concerns over short- and long-term adverse effects delayed the definitive studies of supraphysiological testosterone doses to healthy young and older men but were eventually overcome. This was despite the fact that, uniquely among hormones, there is no known disease state in men due to pathologically excessive testosterone secretion. In contrast, in women, supraphysiological testosterone effects are known to produce virilization side effects that may be only slowly and partially, if at all, reversible. However, maintaining clearly supraphysiological testosterone concentrations would require treatment of months (muscle) or years (bone) and would replicate not only a known hyperandrogenic disease state (PCOS) but also potentially increasing risk of hormone-dependent cancers. In these circumstances, it could only be justifiable to replicate in women the salient testosterone dose-response studies available from men if the available evidence of dose-response relationship in men was not sufficiently convincing and/or there was reason to think that these dose-response characteristics would be substantially different in women. Overall, the unequivocal dose-response evidence in men together with the available overlap evidence in women appears sufficiently persuasive, so that it is doubtful that women would respond differently from men if their circulating testosterone levels were raised to the male range. More broadly, there is no more reason to require separate studies in women vs men than there is for every different ethnic subgroup of people. An aesthetic preference for splitting categories is not a sound reason to require the virtually impossible standard of establishing fresh and comprehensive empirical evidence in women of testosterone dose-response effects ranging into male circulating testosterone concentrations.

An analogy can be drawn to the World Anti-Doping Agency's practice of accepting salient surrogate evidence for banning the plethora of existing and new drugs with potential but individually unproven ergogenic effects where it is not feasible or ethical to require direct proof of the ergogenic effects. In that

context, the firmly established ergogenic efficacy of androgens (on muscle mass and strength) and increased hemoglobin (on endurance) [evidence reviewed in (1)] mean that chemical substances or methods that increase endogenous testosterone, erythropoietin, or hemoglobin are also considered ergogenic (178). By parity of reasoning, if a condition causes a female athlete's circulating testosterone levels to be in the male range, well exceeding normal female levels, with consequential increases in muscle, hemoglobin, and bone effects (at least), an ergogenic effect may reasonably be assumed.

Conclusions

The available, albeit incomplete, evidence makes it highly likely that the sex difference in circulating testosterone of adults explains most, if not all, the sex differences in sporting performance. This is based on the dose-response effects of circulating testosterone to increase muscle mass and strength, bone size and strength (density), and circulating hemoglobin, each of which alone increases athletic capacity, as well as other possible sex dichotomous, androgen-sensitive contributors such as mental effects (mood, motivation, aggression) and muscle myoglobin content. These facts explain the clear sex difference in athletic performance in most sports, on which basis it is commonly accepted that competition has to be divided into male and female categories.

The first IAAF hyperandrogenism regulation specified a hormonal eligibility criterion of a serum testosterone of <10 nmol/L for an androgen-sensitive athlete's participation in the protected category of female athletic events. This threshold was based on serum testosterone measurements by immunoassays.

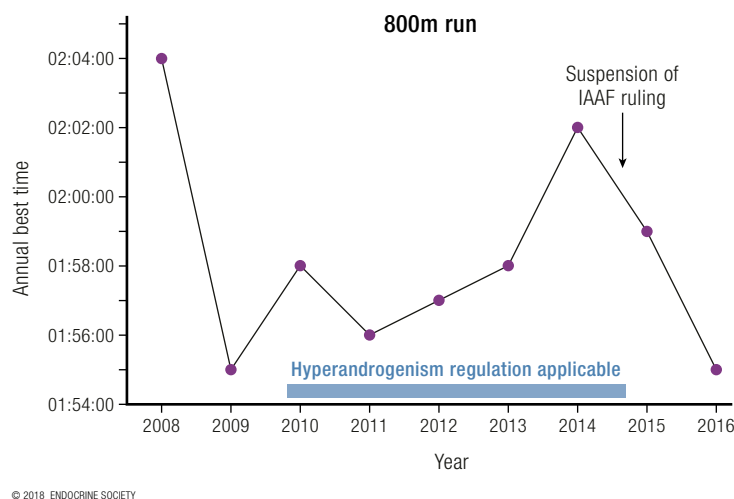


Figure 8. Best annual 800-m times of an elite female athlete between 2008 and 2016. Data provided by Dr. Richard Auchus, University of Michigan, Ann Arbor, Michigan.

Table 5. The Winning Margin in Elite Athletic or Swimming Events During the Last Three Olympics

Median Margin (%) ^a	n	Win Gold	Win Medal	Make Final
Athletics ^b				
Running	81	0.62	0.31	0.22
Jumping	24	0.92	0.42	0.92
Throwing	24	1.93	0.70	0.75
Swimming ^c				
Backstroke	12	0.56	0.28	0.16
Breaststroke	12	0.84	0.14	0.17
Butterfly	12	0.52	0.48	0.12
Freestyle	30	0.49	0.23	0.14
Relay	18	0.37	0.35	0.12

^aWinning margin is defined as the difference (expressed as a percentage of the faster time) between first and second place (Win Gold), between third and fourth place (Win Medal), and between the last into the final and the first that missed out (Make Final). Years (2008, 2012, 2016) and sexes were combined as there were no significant differences in winning margin between them.

^bRunning includes 100 m, 200 m, 400 m, 800 m, 1500 m, 5000 m, 10,000 m, marathon, and 3000-m steeplechase, 110-m (male)/100-m (female) and 400-m hurdles, 4 × 100-m and 4 × 400-m relays, and 20-km and 50-km walk events. Jumping includes high jump, long jump, triple jump, and pole vault events. Throwing includes javelin, shot put, discus, and hammer events. Heptathlon and decathlon were not included as their final results are in points, not times.

^cEvents comprise 100 m and 200 m for the four strokes and 50 m, 100 m, 200 m, 400 m, 800 m (female)/1500 m (male) and marathon 10 km, with the relays being the 4 × 100-m medley and 4 × 100-m and 4 × 200-m freestyle relays.

However, no reliable method-independent consensus threshold could be established using commercial testosterone immunoassays, as these assays differ systematically due to method-specific bias arising unavoidably from the specificity of the different proprietary antibodies employed (25). Based on measurements using the more accurate and specific mass spectrometry methods, if the objective is to require female athletes with congenital conditions that cause them to have serum testosterone concentrations in the normal male range to bring those levels down to the same range as other female athletes, then (allowing for PCOS athletes) the threshold used should not be >5.0 nmol/L. This represents a conservative criterion that includes all healthy young (<40 years) women, including those with PCOS. Conversely, this criterion is generous to intersex/DSD females in allowing them to maintain a higher serum testosterone (2 to 5 nmol/L) than most non-PCOS competitors in female events even though increases in muscle mass and strength and hemoglobin would be expected in this range. This is so even though the range remains below the circulating testosterone levels of middle male puberty when the major biological effects of men's higher circulating testosterone begin to be fully expressed. Ongoing compliance with the eligibility criterion is also an important variable because the estrogen-based suppression of circulating testosterone, typically using daily administered estrogen products, has a rapid onset and offset. Adequate monitoring to prevent gaming of eligibility criteria would require

regular random rather than announced blood sampling.

A related matter is how long such a threshold of circulating testosterone should be maintained prior to competition. In both intersex/DSD and transgender individuals, the developmental effects of adult male circulating testosterone concentrations will have established the sex difference in muscle, hemoglobin, and bone, some of which is fixed and irreversible (bone size) and some of which is maintained by the male circulating testosterone concentrations (muscle, hemoglobin). The limited available prospective evidence from initiation of transgender cross-sex hormone treatment suggests that the advantageous increases in muscle and hemoglobin due to male circulating testosterone concentrations are induced or reversed during the first 12 months and the androgenic effects may plateau after time. This time course is much faster than the somatic effects of male puberty, which evolve over years and for some variables (e.g., peak bone mass) are not complete for up to a decade after the start of puberty. However, the abrupt hormonal changes induced by medical treatment in intersex/DSD or transgender individuals may be telescoped compared with male puberty where circulating testosterone concentrations increase irregularly and incompletely for some years. Additional data are available from the unique investigative model of men undergoing castration for prostate cancer. Just as androgen sensitivity to testosterone may differ between tissues (65), the time course of offset of

androgen effects following withdrawal of male testosterone concentrations may also differ between the major androgen-responsive tissues. For example, circulating hemoglobin shows a progressive fall for 6 months reaching a nadir and plateau at 12 to 16 months in six studies involving 534 men undergoing medical castration for prostate cancer (179–184). Although these studies of older men with prostate cancer must be extrapolated with caution, age, stage of disease, race, and baseline circulating

testosterone concentration did not affect the rate or extent of decline in hemoglobin (179, 181). Comparable longitudinal studies of muscle loss, strength, and performance following castration for prostate cancer are well summarized (185), showing progressive loss for 24 months (see Fig. 4). Further clinical studies to define the time course of changes, mainly offset, in testosterone-dependent effects, notably on muscle and hemoglobin, are badly needed to determine the optimal duration for cross-sex hormone effects in sports.

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Correspondence and Reprint Requests: David J. Handelsman, PhD, ANZAC Research Institute, University of Sydney, Hospital Road, Concord Hospital, Sydney, New South Wales 2139, Australia. E-mail: djh@anzac.edu.au.

Disclosure Summary: D.J.H. is a medical and scientific consultant for the IAAF and to the Australian Sports Anti-Doping Agency. He is a member of the World Anti-Doping Agency's Health, Medicine and Research Committee and of the IOC working group on hyperandrogenic female and transgender athletes. He has received institutional grant support from Besins Healthcare and Lawley for investigator-initiated clinical studies in testosterone pharmacology and has provided expert testimony in testosterone litigation. A.L.H. is a medical and scientific consultant for the Swedish Olympic Committee and a member of the IAAF and IOC working groups on hyperandrogenic female athletes and transgender athletes. She has received grant support from the IAAF for a study on testosterone and physical performance in women. S.B. is a medical and scientific consultant for the IAAF and a member of the IAAF and IOC working groups on hyperandrogenic female athletes and transgender athletes. The authors have no other involvement with any entity having a financial interest in the material discussed in the manuscript. Opinions expressed in this review are the personal views of the authors and do not represent those of the IAAF, IOC, World Anti-Doping Agency, or Swedish Olympic Committee.

Abbreviations

AR, androgen receptor; CAH, congenital adrenal hyperplasia; CAIS, complete androgen insensitivity syndrome; DSD, disorder (or difference) of sex development; F2M, female-to-male; IAAF, International Association of Athletic Federations; IOC, International Olympic Committee; LC-MS, liquid chromatography–mass spectrometry; M2F, male-to-female; PAIS, partial androgen insensitivity syndrome; PCOS, polycystic ovary syndrome; SHOX, short stature homeobox.